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THE EFFECTS OF STRUCTURALLY MANIPULATED TEXT ON LANGUAGE DEFICIENT POOR READERS

by

© JEANETTE OLIVINE BOND

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF EDUCATION

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ABSTRACT

The purpose of this study was to assess the degree to which deficits in syntactic, semantic or phonetic aspects of language underlie poor reading comprehension.

This view rested upon Shankweiler and Liberman's (1976; 1979) position that reading involves the comprehension of those structures which are directly represented in print; and on Guthrie's (1973) suggestion that fluent reading requires interdependent skills.

Therefore, it was proposed that since children customarily use only those language structures with which they are familiar, poor readers may support hidden language deficiencies. These may become apparent only when they attempt to integrate phonetic, syntactic and semantic structures at an arbitrarily set level of difficulty--that is, at a level as is imposed by a given reading selection.

The objective of the study was to assess the effects of providing poor readers with reading materials which had been altered to accommodate a weak language skill area.

The participants chosen for comparison were 32 grade six students reading at that level and 52 age and grade peers who were reading 1½ - 2 years below grade level.

All students were assessed on vocabulary, syllabication and syntax measures. They were then randomly assigned to one of three versions of a silent reading comprehension test. Format A was the unaltered form of the original *Reading 360* informal reading inventory. Format B was

was reduced in syntactic complexity. Format C was restructured so that words of over two syllables were hyphenated. Vocabulary was held constant over the three formats. An adequate reading response to format was arbitrarily set at 70 percent. Such students, whether good or poor readers, were designated as responders.

Results of the statistical analysis were as follows: Good readers were found to be significantly superior with respect to both syntax and vocabulary but were not differentiated from poor readers in syllabication ability.

Good and poor readers were significantly differentiated with respect to (unaltered) Format A reading comprehension but could not be differentiated on either of Format B or Format C. The apparent effect of the latter two formats was to eliminate the differences between good and poor readers. The analysis also indicated that the subjects were differentially affected by the format type they attempted. *Subsequent Hotelling* t^2_2 *analysis* indicated the following: Poor reader responders to syntactically reduced text were found significantly less aware of syntactic structures than were a control group of good reader responders to (ABC). They were not however, differentiated with respect to vocabulary and/or syllabication ability. Conversely, poor reader nonresponders to B demonstrated age-appropriate syntax scores. As regards Format C: poor reader responders were not differentiated from controls with respect to syllabication skills. Non-responders to C were found significantly less developed in vocabulary than were controls. This suggests that the format aided only in providing access to an existing proficient vocabulary.

These results suggested qualified support for the previously stated theoretical positions. The poor readers appeared able to integrate skills, thereby increasing reading comprehension when textual material was matched to their linguistic competencies. A close reading-speech relationship was evidenced at least with respect to vocabulary and syntax. Overall, the analysis indicated qualified support for the basic hypothesis of the study; and suggests that poor reading comprehension might best be viewed as a failure to integrate language component skills at the developmental level arbitrarily imposed by script.

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CHAPTER I

Introduction to the Study

The literature on reading difficulties is full of heated debate about whether or not dyslexia exists (Downing and Brown, 1967; Franklin, 1962) Such arguments have arisen in response to current disillusionment concerning the effectiveness of intervention procedures which purport to remediate reading difficulties.

A recent review (Arter and Jenkins, 1979) concerning the effectiveness of remedial intervention, suggests that current tests and methods are not justifiable in terms of outcomes. However, in order to design effective programs it is necessary to determine just what it is that one is attempting to prevent or treat. Here lies the core of the problem.

Although the terms *dyslexia* and *reading disability* are used interchangeably throughout this study, they do not refer to any well defined disorder. The terms may refer to either to an hypothesized constitutional disorder or alternately to a heterogenous group of reading disabilities in which reading attainment is far below that expected on the basis of age and I.Q. (Rutter, 1978)

A rather typical example of the former type of definition of dyslexia or specific retardation is provided by the World Federation of Neurology which states as follows:

> a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence and socio-cultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of constitutional origin. (Rutter, 1978, p. 12)

Rutter (1978) has pointed out that this type of definition is too ambiguous and exclusionary in nature to provide a basis for research. For example, what is "conventional instruction", "adequate intelligence" or "adequate socio-cultural opportunity"? One might interpret such a definition to suggest that dyslexia cannot occur in children of below-average intelligence, in children from deprived backgrounds or in children taught by unconventional reading instruction, i.e., i.t.a. etc. (Rutter, 1978)

With respect to intelligence, for example, such exclusion contradicts the common experience "...that many psychometrically 'dull' and 'borderline' children in fact show a degree of reading failure that would not be predicted from their mental age" (Benton, 1978, p. 455) " In short, it suggests that if all known causes of reading disability can be ruled out, the unknown (in the form of dyslexia) should be invoked" (Rutter, 1978, p. 12)

The most important reason the definition is unsatisfactory, is that it suggests that dyslexia is a unitary condition caused by constitutional defect. Consequently, research has tended to focus on various aspects of brain function thought prerequisite to reading acquisition while placing little emphasis on the nature of the reading process itself.

As might be expected, studies based on such definitions have yielded contradictory results. They vary greatly depending upon the definition of reading disability, the population sampled, the tests used but most importantly upon the investigator's interpretation of results (Vellutino, 1978)

Proceeding from the suspicion that diverse explanations of reading disability might be reflective of *difficulties in the interpretation of results*, Vellutino (1978) undertook a critical review of such studies. He found that despite the diversity which exists, five basic processes have been consistently implicated as causal to dyslexia. They are: visual perception, intersensory integration, temporal ordering and/or sequencing and verbal processing.

Of all the theories advanced, there is little doubt that the *perceptual deficit hypothesis* has received the most attention in the literature (Vellutino, 1978) Positional and directional errors have long been thought to support a perceptual deficit theory (Orton, 1937; Bender, 1957; Birch, 1962). Vellutino suggests, however, that transpositions and reversals are in fact linguistic intrusion errors caused by imprecise verbal mediation, rather than visual distortions caused by dysfunctions at the level of the central nervous system. His own investigations (1973; 1975) demonstrated that such errors occur only with symbolic material and not with nonlinguistic sequential material. He contends that children who call "b' "d' do not literally see differently from normal readers but because of verbal processing difficulties cannot remember which verbal label goes with which printed symbol (1978).

Vellutino (1978) suggests further that "If one carefully analyzes the reading process it will become clear that this function taxes the visual and linguistic systems unequally and further that the heavier burden appears to be on the side of language" (Vellutino, 1978, p.73) For example, he suggests that of five categories of information contained in a single word, i.e., graphic, orthographic, phonologic, syntactic and semantic, three pertain to linguistic functions.

Support for this contention is advanced by Benton (1962). In a review of the conflicting results of perceptual-deficit research, Benton concluded that deficient form perception and disturbed directional functioning are not important correlates of reading disability. He also suggested that reading disability at the age levels assessed in his review, i.e., 9 years and above may have been due to dysfunction in verbal mediation. However, he allowed that in younger children perceptual difficulties were a more salient factor. Vellutino's review of these and other studies indicated at best tenuous support for a perceptual deficit hypothesis.

Birch and Belmont (1964) demonstrated that the *ability to integrate auditory and visual information* differentiates good and poor readers, and further that this ability improves with age. They also demonstrated (1965) that skills in auditory-visual integration were correlated in the normal population with reading ability.

A difficulty with these studies is that they did not differentiate perceptual discrimination within sensory modalities, nor did they differentiate temporal-spatial integration from cross-modal integration (Rutter, 1978; Bryant, 1975)

Support for this contention can be derived from a study by Zigmond (1966) who found that poor readers were inferior to good readers on nine measures of auditory (intrasensory) functioning. Consequently, the poor readers were also deficient in six out of seven intersensory tasks as well.

Similar conclusions may be drawn from Vellutino's appraisal of studies which demonstrated deficiencies for poor readers in *temporal-spatial* integration. Blank and Bridger (1966) and Blank, Weider and Bridger (1968) had their subjects judge the equivalence of visually presented dot patterns. In one condition the patterns had to be tapped out, and in a second condition the patterns had to be verbally imitated. It was only in the latter condition that difficulties arose for the reading disabled group, and led to the conclusion that some reading retarded children have difficulty remembering temporal patterns only when a verbal medium is used (Bakker and DeWitt, 1977).

A considerable number of studies tend to support the view that simultaneous and successive processing of information are subserved by two separate sections of the brain (Luria, 1973; Reitan and Davison, 1975). Within this context, considerable interest has been evidenced in relation to the accurate *processing of temporal sequences and the recall of serial positions for visual and auditory stimuli* (Rourke, 1978). Bakker

(1967) found that readers who were moderately retarded in reading could be differentiated from severely retarded readers in their memory for meaningful sequences of letters or digits, but were not differentiated with respect to nonmeaningful sequences, i.e., shapes.

There is an important difference between meaningful and nonmeaningful items. Meaningless figures cannot be named while meaningful figures can be given a label. When the task requires that serial items, which are verbal in nature, be retained, poor readers are differentiated from better readers. However, when the recognition of a series of symbols depends on nonverbal characteristics, the differences between the groups disappear. Similar results have been reported by other investigations (Groenendall and Bakker, 1971; Corkin, 1974; Young and Rourke, 1975).

Vellutino's critical review of these and other studies has led him to the *conclusion* that observed differences between reading disabled and normal readers in investigations concerned with visual perception, intersensory integration, temporal-spatial integration or sequential memory may be attributed to differences in verbal encoding ability (Vellutino, 1973; 1975;1978)

In response to the difficulties of interpretation associated with studies based upon classical definitions of dyslexia, *modern approaches to research* do not assume the existence of dyslexia or of specific reading retardation. Instead it involves the investigation as to how the broad group of poor readers may best be subdivided (Rutter, 1978) Here the definition is concerned with determining the level of underachievement which may constitute a reading disability (Rutter, 1978).

One of the earliest *attempts to measure underachievement* was that of Franzen (1920) who developed the "Accomplishment Quotient". This consisted of the ratio between attainment age and mental age. Franzen's Accomplishment Quotient was the forerunner of a more sophisticated version by Myklebust (1967) which involved the ratio between learning potential and achievement (Gaddes, 1976).

The most important objection to the use of such ratios is that of statistical regression effects (Crane, 1959; Thorndike, 1963). The assumption underlying the ratios is that there exists a one-to-one correlation between reading age and mental age, whereas the actual value is +0.6. When the correlation between two measures is less than unity, children superior on one measure, i.e., mental age, will be less superior on the other measure, i.e., reading age. At the other end of the continuum, children who are well below average on the first measure, will be less inferior on the second measure (Yule and Rutter, 1976). Failure to allow for the statistical effects of regression will result in a group of low readers in whom bright children are overrepresented and dull children are underrepresented (Yule and Rutter, 1976)

As a solution to the dilema associated with regression, Thorndike (1963) suggested that underachievement be defined as the discrepancy of actual achievement from a value predicted on the basis of the regression equation between aptitude and achievement. Knowing the correlation between a predictor variable and a criterion variable, it is possible to calculate the expected value of the criterion, i.e., reading for any particular level of the predictor variable. Degrees of reading retardation can then be defined in terms of the empirically determined relationship between intelligence and reading, thus avoiding the errors in classification associated with the regression effect (Yule and Rutter, 1976).

This procedure was used to define and differentiate two types of reading retardation in a series of epidemiological *total population studies* on reading difficulties (Rutter, Tizard and Whitmore, 1970; Yule, 1973; Berger, Yule and Rutter, 1975). This investigation employed the data from 2,300 nine and ten-year olds on the Isle of Wight.

Reading Backwardness was defined as "An attainment on reading accuracy which was two years four months below the child's chronological age" (Yule and Rutter, 1976, p. 32). *Specific Reading Retardation* was defined as "...An attainment on reading accuracy or reading comprehension which was two years four months or more below the level predicted on the basis of the child's age and WISC I.Q." (Yule and Rutter 1976, p. 32).

Reading backwardness was found to be associated with a wide range of motor, praxic, speech and neurological disorders.

Specific reading retardation, was found to be associated only with abnormalities of speech and language development. In addition, reading backwardness was more commonly found in large families and is also more frequent in children of low-socio-economic status. Specific retardation was also more common in large families but does not occur more frequently in families of low socio-economic status. Finally, the preponderance of boys, so often referred to in the literature was found in the specific retarded group, i.e., 3 to 1, while sexes were equally represented in the backward group.

The striking similarities between the characteristics of children classed as *reading retarded* in the Rutter and Yule study (1973) and those generally thought to be *dyslexic*, raises the question as to whether specific retardation and dyslexia are the same thing. A review of the literature on dyslexia yields a highly variable description of symptoms thought to be associated with the disorder (Yule and Rutter, 1976) Reading disability has been associated with disorders of speech and language, clumsiness, or lack of co-ordination, difficulties in the perception of spatial relationships, directional confusion, right-left confusion, disordered temporal orientation, difficulties in naming or recognizing the meaning of pictures, inadequate or mixed cerebral dominance, bizarre spelling errors, and a family history of reading difficulties (Yule and Rutter, 1976).

The researchers note, that with the exception of mixed handedness, most of the characteristics have been weakly associated with their reading retarded group. However, only speech and language difficulties and problems with sequencing were consistently and strongly associated with reading retardation (Rutter and Yule, 1973). Thus, reading retardation as defined by Rutter and Yule (1973) is not synonamous with dyslexia as it is currently defined.

Recent dyslexia research (Mattis, French and Rapin, 1975) finds support for the position that classical symptomology is not an important correlate of reading disability. The primary purpose of this study was to differentiate and/or identify subtypes from within the population commonly thought of as dyslexic. The researchers suspected that although the children demonstrated many of the symptoms of central nervous system dysfunction associated in the literature with dyslexia, only a few of these would be causally linked to the disorder. They therefore contrasted dyslexic children with brain damaged children, i.e., with symptomology, who were able to read.

Interestingly enough, hyperkinicity, severe gross and fine motor dyscoordination, etc. were found mainly in the able reader (brain damaged) group. Then, by disregarding as causal to dyslexia those neurological symptoms found in the brain damaged good reading group, the following *dyslexia syndromes* were isolated: (a) a language disorder involving naming difficulties and disorders of immitative speech, (b) an articulatory and attendant graphomotor dyscoordination disorder, and (c) a visuospatial perceptual disorder (Mattis, 1978).

Mattis (1978) reported a follow-up cross-validation study in which demographic, social, financial, academic, medical-neurological and neuropsychological data were obtained for 400 children. The three syndromes again appeared. Mattis found that 63 percent of the children presented with the language disorder, 10 percent the articulatory and graphomotor discoordination syndrome, and 5 percent the visuo-spatial disorder. Similar results were reported by Denckla (1977) in a retrospective study of 52 dyslexic children. The Mattis study suggests that the presence of neurological indicators is not an important correlate of reading disability. However, language and speech difficulties, which were demonstrated by 65 to 75 percent of the sample, appear to be highly symptomatic of severe reading disorders.

Taken together, the studies demonstrate strong support for a *language deficit hypothesis* concerning the etiology of reading disability. If as previously suggested, visual-perceptual and/or various integration problems are surface indicators of underlying language disorders (Vellutino, 1973; 1975; 1978), remedial procedures designed to correct the former disorders should be largely ineffective. This concern is addressed in the research review in the following chapter.

Vellutino (1978) suggested that, children who have difficulties in relating the semantic components of words to their acoustic equivalents, acquiring an awareness of the phonetic structure of speech or developing a command of syntactic structures will have difficulty integrating these components and lack skill in their application. The following chapter will examine the viability of considering phonetic, semantic and syntactic structures as component reading skills, by determining the degree to which these find direct representation in print.

The strength of the Vellutino assertion is that it flows from a thoughtful analysis of those component skills and processes which seem reflective of proficient reading. It also implies that he recognizes the most immediate and apparent symptom of reading disability to be a demonstrated inability to integrate the components of the reading process. Such deficiencies, he suggests, occur as a result of either a limited fund of information or the inaccessibility of this information (Vellutino, 1978) The following research will investigate the reading process with respect to the interaction of component skills in both fluent and retarded reading. Therefore, an attempt will be made to determine how limited or inaccessible information at the level of linguistic structures affects this interaction of component skills.

In the light of the above considerations, a *tentative definition of reading disability* will be advanced. This will constitute a qualitative definition which will provide a framework for this experimental study.

In addition, a quantitative definition will be employed for purposes of sample selection. The definition simply recommends the selection of children who are reading 1½ to 2 years or more below grade level (Eisenberg, 1966; Newbrough and Kelly, 1962; Schain, 1972; Walzer and Richmond, 1973).

CHAPTER II

Review of Literature and Related Research

An attempt has been made to contrast research concerning reading disability with current hypotheses concerning the nature of the reading process. The paucity of information concerning the etiology of reading disability suggests that a fruitful investigative approach would be to determine those underlying skills and processes which inhere in fluent reading. Reading disability is suggested to be representative of deviations in the orderly acquisition of these skills and processes.

The Effectiveness of Current Methods of Remediation

In a recent review, Arter and Jenkins (1979) have presented findings which seriously challenge the continued advocacy of remedial intervention based on the "Differential Diagnostic-Prescriptive Teaching" model (Kirk, 1972, p. 7; Kirk and Kirk, 1971, p. 12). The term "differential diagnosis" refers to the practice of determining the learning characteristics of the child, i.e., skill strengths and deficits, so that ongoing instruction can be tailored to individual learning needs (Arter and Jenkins, 1979). According to this model, failure to master basic skills such as reading, may be traced to impairments in abilities that are prerequisite for or underlie academic learning (Mann, 1971; Ysseldyke, 1973). The term "diagnostic Prescriptive teaching" involves the practice of formulating instructional prescriptions on the basis of the results of differential diagnosis (Arter and Jenkins, 1979).

These prescriptions generally take on one of two forms. In one form, the diagnostic information is used to develop a program to remediate underlying abilities. In a second form, instructional programs are devised which gear instruction to the strengths of the child, i.e., modality teaching (Arter and Jenkins, 1979). The authors contend that neither approach has resulted in academic improvement in the majority of the studies reviewed. Arter and Jenkins (1979) found that ability groups outperformed untrained controls in only one-third of the investigations (Hammill & Larson, 1974; Goodman and Hammill, 1973; Hallahan and Cruickshank, 1973; Kleisius, 1972). Fourteen studies were reviewed which reported the results of efforts to improve beginning reading by matching instruction to children's modality strengths. In none of these was reading improved as a result of modality teaching (Arter and Jenkins, 1977; Ysseldyke, 1973).

Underlying the differential-diagnosis model are several assumptions regarding prerequisite abilities and their relationship to academic skills. Of particular interest is the degree to which underlying abilities may be measured as well as their susceptibility to modification through training (Arter and Jenkins, 1979).

First, the ability training model may itself be invalid. Underlying abilities may not exist as they are currently being defined, or they may exist but be an unimportant factor in instruction (Arter and Jenkins, 1979). Two major obstacles have thwarted attempts to identify and/or assess the abilities in question. First, the terminology used to name abilities has presented a problem since their is little agreement as to what is meant by such terms. For example, Hammill (1972), in reviewing 33 studies of perception, found that some authors considered the term to mean the entire perceptual process. Others made a distinction between sensation and perception. Finally, a few authors distinguished among sensation, perception, and cognition.

Arter and Jenkins (1979) suggest that differences in terminology make tests and their results ambiguous, especially for those who design instructional materials.

A second difficulty is that the diagnostic tests attempt to measure hypothetical constructs. This is a problem. Since underlying abilities are assessed by measuring performance on activities thought to require that ability, no test can be considered a pure measure of the ability (Arter and Jenkins, 1979). For example, putting shapes in a sequence requires visual sequential memory, motor ability and the ability to understand verbal instructions of the task requirements (Arter and Jenkins, 1979).

The authors suggest that it is not surprising that the model has not improved academic achievement since most ability assessment devices have inadequate reliability and suspect validity (Arter and Jenkins, 1979). Although the studies reviewed occasionally report satisfactory concurrent validity correlations, overall results are disappointing. An exception is the Grammatic Closure subtest of the *Illinois Test of Psycholinguistic Abilities (ITPA)*, with measures of reading achievement (Arter and Jenkins, 1979).

The strongest case for the predictive validity of diagnostic tests can be made only with certain auditory measures, i.e., Auditory Association subtest, ITPA. Studies of diagnostic validity present a similar picture. Neither the ITPA nor miscellaneous visual perceptual tests appear capable overall of discriminating between good and poor readers. Only the ITPA subtests Gramatic Closure and Sound Blending were successful in differentiating between groups of readers in more than one half of the 14 studies reviewed.

Studies which considered construct validity yielded mixed results. Waugh (1975) and Newcomer, Hare, Hammill and McGettigan (1974) advance support for Gramatic Closure and Sound Blending. There is no empirical support for the five separate abilities hypothesized by Frostig (Arter and Jenkins, 1979). Arter and Jenkins (1979) state that they do not suggest that the model is untenable but with current instructional programs and tests, the model is not useful.

A number of authors who have reviewed various aspects of the 'differential diagnosis-prescriptive teaching model' lend support to this contention (Hammill and Larsen, 1974; Sedlack and Weener, 1973; Silverston and Deichman, 1975; Ysseldyke, 1973). With reference to psycholinguistic training, Newcomer et al. (1975) write:

> We cannot help but conclude that psycholinguistic training based on the Kirk-Osgood model is not successful because it does not help children to increase their ability to speak or understand language, nor does it aid them in academic skills such as reading, writing or spelling. . . the wrong skills are being remediated (p. 147).

This is not the view held by most authorities and practitioners in special education. In a statewide American survey, it was found that 82% of special education teachers believed that they could and should train weak abilities, 99% thought that a child's modality strengths and weaknesses should be a major consideration in devising remedial programs, and 93% believed that their students profited from modality instruction (Arter and Jenkins, 1977). However, this review suggests that the continued advocacy of the model cannot be justified. Children do not appear to profit under current applications of this method of remediation (Arter and Jenkins, (1979).

Language Components which are Recoded in Script

Implicit in both remedial assessment and remedial programs is the researcher's theory of what constitutes normal reading. For example, if one perceives reading to be primarily a visual task, and as such dependent upon visual acuity, scanning ability, etc., then appraisal procedures will emphasize the visual aspect. If reading is considered to entail mainly word recognition, then appraisal will centre on sound-symbol association and related underlying skills, i.e., auditory and visual perception and discrimination

(Strang, 1969). Such limited perceptions of the reading process appear to underlie much of the research covered in the present review. It is not surprising that remediation, based on such a limited view of the reading process is successful only in the minority of cases.

A reading authority, Ruth Strang (1969) considers the normal reading process to comprise three integrated components:

1. The ability to decode or decipher the author's printed words.

2. The ability to associate these words with meaning gained through linguistic social experience.

3. The ability to appraise, modify and express ideas gained through reading.

Strang describes the normal reading process as a communication between the author and the reader. Reading, then is a meaningful process in which the reader acts upon the ideas gained and alters these to fit his experience (Strang, 1969).

While reading involves both visual and language skills, it appears that the process taxes the visual and linguistic systems unequally. The heaviest burden falls on the linguistic system (Vellutino, 1978). If reading ability reflects an underlying ability to process language, we should find that cortical processing systems which subserve language will subserve reading as well (Wiig and Semel, 1976). Recent research has supported the position that normal language processing involves the integration of information from three language subsystems which have different areas of cortical representation. Luria (1973) postulated three neuropsychological processes considered to be necessary for the processing of complex language:

1. Memory and the retention of sentence elements, involving the left temporal lobe.

2. Simultaneous analysis and synthesis of the elements, involving the parieto-occipital area.

3. Active analysis and cognitive appriasal, involving the planning activities of the frontal lobes.

The above are processed somewhat in concert rather than as steps in a sequence (Wiig and Semel, 1976). As in the processing of complex language, Strang's (1969) definition suggests that fluent readers appear able to consider three parallel types of information simultaneously. If we assume that the speech system develops through the encoding of acoustic signals into progressively more abstract representations, we must also assume that reading acquisition would involve the modification of the speech perception system to accept optical information (Shankweiler and Liberman, 1976). Hawles (1968) has pointed out that it would be unparsimonious to imagine a completely parallel language comprehension system for reading that borrowed nothing from the primary speech system. The degree to which reading is related to language functions will depend upon the level of representation to which script is recoded (Shankweiler and Liberman, 1976).

Certain facts about the writing system are relevant to this argument. All writing systems make contact with spoken language (Shankweiler and Liberman, 1976). Chinese and Japanese logographs represent whole words while other languages tie in at the level of the syllable. It is interesting that Chinese patients with severe injury to the temporal lobe (unlike an English speaker) are usually still able to read and write, because their script is based on ideographs instead of words that call for the coding of phonemes (Luria, 1970).

In English, script makes contact with language at more than one level: (a) the phonological level at which spelling reflects the sound of the word, (b) the morphological level at which a similarity of spelling may denote not similarity of sound but similarities of word origin and meaning, such as in the word pairs sign and signal, and (c) the syntactic level at which assignment of grammatical function may determine the phonetic form i.e., the word 'contract' is ambiguous as to pronounciation until we know whether it functions as a verb or as a noun (Rozin and Gleitman, 1976). This knowledge is dependent upon the word order of a sentence.

Although the alphabet is roughly a cipher based on the phonemes of spoken language, this does not indicate that learning to read is simply a matter of acquiring letter-sound correspondence (Shankweiler and Liberman, 1976). The experienced reader has learned to detect and exploit such multileveled representation. Shankweiler and Liberman (1976) add ". . . we do not assume that the reader is tied to a rigid hierarchy of successive processing stages. Rather, we suppose that the transformation of script into speech occurs at a number of levels concurrently and in parallel" (p. 299). A prerequisite for fluent reading is the linguistic awareness of words, sentences and the component parts of words, i.e., phonemes and syllables.

A. Phonological Level

"The phonological system is not in itself speech, but is manifested as speech for purposes of communication. It is thus an intermediate strand of language structure between the lexico-grammatical system and articulate, audible speech" (Francis, 1965, p. 193). The units of the phonological system are phonemes. They can be defined as the smallest units of sound, and are represented in script by consonants and vowels, that is by single letters (Francis, 1965). The smallest phonological construction is the syllable.

Wepman (1960) has noted that the ability to discriminate highly similar phonemes frequently develops as late as eight years of age. This is possibly because consonants and vowels are not discrete, but are overlappingly represented in the syllable (Shankweiler and Liberman, 1976). Osgood's (1963) morphemic analysis suggests that he considers the syllable to be the basic unit of expressive speech.

Leong and Haines (1979) found that children from grades one to three had great difficulty determining the number of phonemes in one syllable words. Children in grade one also evidenced difficulty in determining the number of syllables in a word. However, the data from the same study ~~suggests~~ a steep rise in ability to segment words into syllables between grades one and two with a leveling off in this ability between grades two and three.

In a similar paradigm, Shankweiler and Liberman (1976) report steep age trends for analysis of words into both types of segments. At each age tested, i.e., four to six years, words were more easily segmented into syllables. At age four, none of the children could segment into phonemes and only 50 percent could segment by syllable. At age six, 70 percent could segment in phonemes while 90 percent could segment words into syllables.

Fox and Routh (1975) found a developmental progression in the ability to analyze sentences into words, words into syllables and syllables into phonemes in children three to seven years of age. In a more recent study, the same researchers found that the ability to segment syllables into sounds was a good predictor of the ability to sound out unknown words (Fox and Routh, 1976).

Delays or deficits in phonemic discriminative ability would seriously hinder the acquisition of reading skills beyond the grade one level. Luria (1970) suggests that spelling errors based on poor phonemic reception are evidenced in letter substitutions. Typically the speller cannot distinguish "b" from "p" or "t" from "d". The word "dome" might be written as "tome", whereas the word "ball" might be spelled as "pall".

Intimately related to the reception of phonemic sounds is the expression or articulation of speech sounds. In relation to writing, it can be noted that people customarily pronounce an unfamiliar word before writing it (Luria, 1970). Nazordva (1952) found that when articulation was not permitted, the number of writing errors made by first and second graders was increased between five and six times.

Spelling difficulties resulting from articulation errors are based on an inability to distinguish kinesthetically, sounds made with near identical tongue and lip movements (Luria, 1970). Consequently, such people confuse the letters: "d", "e", "n", and "l", and are likely to render substitutions such as "spal" instead of "span" or "cam" instead of "cab".

Reading and spelling involve two overlapping yet distinct processes. At the level of phonemic awareness, spelling errors may reflect deficits or delays in the acquisition of either the reception of phonemes or the articulation of phonemes or both.

In order to read analytically, the child must discover how many letters must be grouped in order to make a phonetic match with a mental representation of a speech segment. Reading a word in isolation depends on the ability to "chunk" it into syllables. Just as Osgood (1963) considered the syllable to be the basic unit in the expressive speech of linguistically competent individuals, Shankweiler and Liberman (1976) suggest that for single word reading, the coding unit is probably the syllable.

Although the analysis of words into syllables is easier than that of phonemic segmentation of speech, many retarded readers have difficulty in syllabicating or breaking up words. Such a difficulty possibly emanates from an inability to hear words as consisting of parts. If the child cannot differentiate syllables in spoken language, he is not likely to recognize these in a graphic representation. Conversely, it can be assumed that since a developmental progression exists in the ability to progressively segment words into syllables and later to segment syllables into phonemes, both systems may be unavailable to the retarded reader. The elimination of one level at which script makes contact with language, i.e., the phonological level, suggests that readers for whom this strategy is unavailable may resort to a wholistic semantic approach to reading words.

B. Lexical-Morphological Level

The second level at which script makes contact with language depends not so much on sound as on visual similarity. Here a similarity of spelling may indicate a common root meaning, i.e., the words sign and signal.

Morphology is the study of the smallest units of meaning called morphemes. Berko (1958) found that children learn a set of morphological rules, which enables them to inflect words. These rules are based on the most consistent and regular features of the English language. Inflections provide semantic information, i.e., number and tense, as well as grammatical information, i.e., marking words as members of form classes (Vogel, 1974).

Some reading retarded children appear to have great difficulty in reading inflectional endings in script and may render a sentence such as "He's going to the store" as "He go to the store". Often such omissions are also noted in their verbal utterances as well and are often perceived as simple articulation errors rather than as indicating a lack of awareness for the particular aspect of meaningful speech. (Wiig and Semel, 1975)

Meaningful syllables in words, i.e., prefixes, roots, and suffixes are also examples of morphemes. Perhaps due to the high frequency of such syllables in the language, even very poor readers can master prefixes such as re, pre, etc., and suffixes such as ing, ed, and tion, particularly if they are taught in isolation initially. However, a few children will omit endings indicating parts of speech such as "ive" or "ly" (adjectives or adverbs). Again, this is often noted in speech as well as reading and spelling.

Because those syllables which have meaning, sound like words, some readers appear to be able to form a mental representation of such items as syllable units. This suggests that for these children, the unit of instruction should be the syllable rather than sound/symbol correspondence. (Gleitman and Rosin, 1973)

The above statement should not be taken to mean that the syllable is the preferred unit of instruction for all children (Leong and Haines, 1979). Gleitman and Rosin (1973) suggested the syllable as a suitable entity with which to learn phonemic principles. However, they point out that the syllable is "neither where the child begins, nor is it where one would want him to end up; in reading; words and phrases are the units with which the child begins. . ." (p. 463).

The term morpheme has a wider application beyond that described thus far. "It refers to any segment of language which has meaning and which cannot be divided into smaller units, all of which have meaning" (Francis, 1965, p. 114). Therefore, the word 'hat' is a single morpheme and so is 'kangaroo'. Neither of them can be shown to exist of smaller parts which also have meaning. On the other hand, 'hat-s' and 'roost-er' are both made up of two morphemes. One morpheme carries the principle part of the meaning of the whole (Francis, 1965). This is called the base or root. In the preceding examples, hat and roost are bases and can stand alone as meaningful words. For this reason, they are called free bases. Other bases, i.e., "s" in hats and "er" in rooster, cannot stand alone but must always appear in association with other morphemes (Francis, 1965). All words in English are made up of these various types of morphemes. For this reason, vocabulary knowledge or semantic understanding can be subsumed by morphology.

Observations of language impaired children indicate that their vocabulary may be as large as achieving peers (Wiig and Semel, 1973). Clinical observations reveal that although some language disabled children have poor vocabulary development, many score within normal limits on tests of receptive vocabulary (Dunn, 1965). The difference in vocabulary development separates these children into subsets of reading impaired youngers, i.e., those children deficient in their general knowledge of word meanings and those who demonstrate average or superior vocabulary knowledge (Wiig and Semel, 1973). Quite a different picture emerges when the latter proficient group attempt to understand words within the context of sentence structure. Under these conditions, a weakness in understanding the meaningful aspects of sentence structure, or inflections, interfere with lexical meaning and/or certain categories of words (Johnson, 1968; Johnson and Myklebust, 1967). When differences in meaning are positional or contextual, learning disabled children can be said to have semantic deficits (Wiig and Semel, 1975). For example, they might have a difficulty understanding the meaning of the word "building" in the sentences "He was in the building" and "He was building the house". As to categorical difficulties, the morphological weakness in language processing is evidenced by difficulties in verb tense, degrees of adjectives and prepositional forms (Wiig and Semel, 1975). Most affected are words which denote time, seriation or directional aspects of space, i.e., length, width. The prepositional difficulty involves the expression of direction, i.e., to the left of. . .to the south of. . .etc.

C. Syntactic Level

The third level at which script makes contact with language is that of syntactical meaning, in which the meaning of a word may depend on its position in a sentence (Shankweiler and Liberman, 1976).

Syntax refers to a body of rules which governs the way words are ordered to convey meaning. Thus, between sound and meaning, stands syntax (Vogel, 1974).

Recently, several authorities have stressed the relationship between reading achievement and a knowledge of structural aspects of the language. Reddell (1965) found that reading comprehension scores of grade four students were significantly higher when the context of the test used high frequency syntax (sentence structure) as opposed to scores on tests using low frequency sentence structure. Reddell sees reading comprehension as a function of similarities between structural patterns in written material and the spontaneous language of the reader (Reddell, 1965).

Menyuk (1964) found that a sentence repetition task differentiated between normal and delayed language groups. Such tests are often considered to determine short-term memory for language. However, Menyuk (1969) pointed out that it was "the structure of a particular sentence which determined whether or not it was repeated, not its length. . .repetition was dependent on structure rather than just immitation up to the limits of memory capacity" (p. 113-114). Hunt (1966) noted the increase in sentence length as well as a higher proportion of subordinate clauses as the child matures.

Wiig and Semel (1975) noted that on their sentence repetition task, reading disabled adolescents showed limited ability to code syntax and exhibited a heavy dependence on the semantic aspects of the sentence. For example: These students would be able to extract concepts such as "cat" and "dog" from the sentence "The cat was bitten by the dog" but would fail to identify who did the biting. The problem is one of processing the meaningful aspects of sentence order (Wiig and Semel, 1976).

Vogel (1974) assessed the syntactic abilities in oral language of twenty normal and twenty dyslexic second graders. She found the dyslexic children to be deficient as contrasted with normals on seven of the nine measures used. Three measures were found to be the best discriminators of syntactic difficulties: *The Berry-Talbott Language Test, The ITPA Grammatic Closure Test,* and the *Test of Recognition of Melody Pattern.* These orally presented tests attempt to measure the degree to which internalized representations of language structure are utilized in the reception of oral language.

The comprehension of the syntactical aspect of a spoken message is aided by the rise and fall of speech melody as well as the pattern of rhythms and stresses. Since these are not in script, they may require the mediation of an internal speech pattern representation in order that the message become comprehensible (Shankweiler and Liberman, 1976, 1979).

Chomsky's (1957) theory of transformational-generative grammar hypothesizes that there is an innate rational ability in children which enables them to generate the underlying rules or syntax of the language if sufficiently exposed to it. McNeill (1965) in following the above rationale, points out that children have the capacity to acquire grammar of immense complexity and richness on the basis of very limited amounts of information, usually before the age of five years. McNeill adds that the capacity to acquire language may be transitory. It may reach a peak between the ages of two to four and decline thereafter. As a special capacity, the ability to effortlessly acquire language may disappear altogether with the beginning of adolescence (McNeill, 1965).

Brown and Fraser (1964) have investigated the acquisition of syntax in very young children. They found that the spontaneous utterances of a group of thirteen three-year old children indicated that the youngsters consistently demonstrated that they used both syntactic and morphological rules. The authors noted that the children's utterances were classifiable as grammatical sentences from which certain morphemes have been omitted.

McCarthy (1954) concluded that all children reduce English sentences in a similar fashion. Omissions do not appear to be random. There seems to be a constant tendency to drop one kind of morpheme and retain another. Retained are: (a) final position in sentence morphemes, (b) reference making forms, and (c) those that belong to noun, verb and adjective parts of speech.

Brown and Frazer conclude that children do not copy their telegraphic speech directly from adult utterances, and suggest that the basic cause is based on an upper limit on immediate memory span for the situation in which the child is immitating. The authors point out that the Digit Span norms on the *Stanford Binet Intelligence Test* would support their contentions, i.e., two digits at thirty months, three at thirty-six months and four at fifty-four months (Brown and Frazer, 1954).

Menyuk (1969) reported that the normal child can handle functional relationships between subjects, predicates, and objects by the time he is three years of age. However, a knowledge of embedded structures continues to develop at least until age thirteen (Wiig and Semel, 1976).

A difficulty in processing sentence syntax often goes unnoticed in the classroom situation, because children tend to use only those grammatical structures with which they are proficient (Wiig and Semel, 1975).

Defining Reading Disability with Respect to the Reading Process

Strang's definition of the normal reading process suggests that reading skills are integrated during fluent reading. That is, that reading involves simultaneous processing of the skills in order that comprehension take place. As such, reading will be considered for purposes of this study as a process involving the integration of the language components as they are represented in script.

A. Skill Integration

Guthrie (1973) suggests two complementary models of the reading process: a "systems" model and an "assembly" model. The latter model considers reading to be an assembly of independent components. Conversely, the former "systems" model sees these components as being interdependent. The researcher found that his "systems" model was appropriate for normal reading in which component skills appear to be interdependent, while his "assembly" model appeared to reflect more accurately reading disabled children, whose skills appear to be independent.

Doehring (1968) used this model to investigate the reading acquisition process. Since, under Guthrie's model, reading is a complex process involving a number of component skills, different forms of reading disability might be evidenced in different patterns of deficiency in the component skills. A defect or distortion in any one of these necessary subprocesses would impair subsequent integration of the component skills. The result would be atypical development of reading skills (Mattis et al., 1975)

Guthrie had suggested that reading disability might be a reflection of the lack of a normal amount of integration between skills (Guthrie, 1973). The failure to integrade reading skills finds expression in the following comments of a fifteen-year old reading disabled boy:

> Well. . .mainly in school you have all those rules about how to read. They say to take a line and read it, but I can't do that. I have to take it word, word, word, and sometimes half a word, and I lose the meaning of what I am reading. . .You see, I'm awfully slow in my reading. People say to speed up your reading by taking a whole sentence. I just can't do that cause I'll just read the words and not know what I'm reading. . .
>
> Strang, 1969, p. 93

Doehring's component theory postulates the "acquisition of separate skills for processing letters, letter patterns or syllables, words and syntactically and semantically related groups of words" (Doehring, 1976, p. 408). With respect to normal readers, Doehring found that these skills were learned over a number of years. Skills mediated by the speech system were prominent during the early stages of acquisition. However, fluent reading, an advanced stage, required the overlearning of these skills to the point where they had become automated. It was not clear whether component skills were independent during early reading but they were found to be interdependent at later more advanced stages (Doehring, 1976). However, if the skills are interdependent at early stages of acquisition, ". . .a deficiency in one or two skills could rapidly lead to a general retardation in all skills" (Doehring, 1976, p. 410).

B. Automatization of Component Skills

Kahnemann (1973) suggests that the ability to perform several activities concurrently is dependent upon the extent to which each component act has become automatic, i.e., can be performed without conscious attention. Complex activities which require the integration of automatic component skills are common in everyday experience. For example, learning to drive a car involves the integration of several component skills. In general, once these skills are highly learned, they become automatic requiring little conscious awareness. Thus it is possible to drive while engaged in conversation unless some special circumstance, i.e., making a turn demands extra attention to the driving whereupon the driver may cease conversing until the turn is completed (Norman, 1976).

Luria (1970) explained the process of automatization in physiological terms. He explained that a well-learned task, i.e., writing ". . .may invoke a stereotype based on a network of cortical zones quite different from the one that was called upon originally when the performance required the help of analytical apparatus" (Luria, 1970, p. 73). By way of example, Luria (1970) cites the case of a patient who, because of injury to the left hemisphere, was unable to write single words upon instruction to do so. However, if she was asked to write a whole sentence quickly, i.e., an automatic kinetic skill, she was able to do so without hesitation. "It appears, therefore, that training or habituation changes the brain's activity so that it comes to perform accustomed tasks without recourse to the process of analysis" (Luria, 1970, p. 73). Luria's explanation of automaticity is consistent with Doehring's view that early reading requires the mediation of the speech system, while advanced reading exhibits an automatization of this process. Further, this suggests that the prerequisite skill for fluent reading is the automatic awareness of words, sentences and the component parts of words, i.e., syllables and phonemes. One might then speculate that reading disabled children are not able to integrate reading component skills because of the failure to automatize one or more of these.

C. Compatibility with Cognitive Representations

The literature reviewed concerning remedial effectiveness (Arter and Jenkins, 1979) suggests that practice in the presumed reading subskills has not, for the most part, resulted in improved performance with respect to the reading disabled population. Such outcomes suggest that memory or attentional difficulties may underlie the poor reader's inability to automatize component reading skills.

The overlap of attentional mechanisms with those of memory has been taken into account in a recent formulation by Craik and Lockhart (1972) who see memory retention as a function of the depth to which a stimulus is processed. Various factors such as the amount of attention devoted to a stimulus, compatibility with existing analyzing structures and processing time determine the depth of processing (Craik and Lockhart, 1972).

With respect to attention and compatibility, a theory advanced by Sokolov (1960) stresses the importance of existing cognitive representations of input information. According to the theory, the presence of these inner representations determines the efficiency with which the brain is able to process stimuli. The theory proposes that reaction to a stimulus elicits a cortical representation of the stimulus parameters. Subsequent stimuli are compared to the acquired inner model. If a match can be made between the new stimuli and the existing model, the item will be processed rapidly and efficiently. An incorrect or partial correspondence would produce excessive attentional scanning and partial processing. Finally, if no model existed the stimulus might be ignored entirely, that is no processing would take place.

Support for the Sokolov position was demonstrated by Levine (1976). The study contrasted two groups of retarded readers, i.e., a visuospatial impaired group and an unknown deficit group with normal controls. Presentations involved a series of auditory items, visual items and auditory-visual integration items. Marked differences in the ability to process stimuli were found among the three groups. Only the normal reader group demonstrated efficient processing (accurate inner representation). The visually impaired group evidenced inaccurate processing and over-attention to the stimuli, suggesting a faulty inner representation of these items. The unknown deficit group appeared to be attending at a level insufficient for processing the stimuli, suggesting a weak or ambiguous inner representation.

A possible explanation for the failure to construct accurate inner representations is suggested by Luria's (1970) position that the cortex reacts very strongly to stimuli perceived as significant and responds very weakly to that which is perceived insignificant. The latter are easily supressed. Somewhat consistent with this assumption, Craik and Lockhart's theory suggests that " highly familiar, meaningful stimuli are compatible, by definition, with existing cognitive structures." (1972, p. 676) These would be processed to a deeper level more rapidly than would less meaningful stimuli. Consequently, meaningful stimuli tend to be well retained i.e., sentences, while stimuli having little or no meaning i.e., digits are quickly erased from memory. Therefore, if some component of script, i.e., word order held little meaning for the reader, it is doubtful that practice in reading would result in automatizing that component. Failure to learn to read may indicate the limits of the reader's awareness of language structures inherent in script. A weak or lacking cognitive representation of such structures might provide a possible explanation for the apparent specific deficits of dyslexic children as contrasted to the more general deficiencies of slow learning children.

The speed of processing is a major factor in reading comprehension. If reading skills are interdependent then a weakness in one skill area might result in an imbalance of prosessing speeds. That is, do children not process nonmeaningful components in favor of maintaining rapid processing of meaningful ones? Some types of information, i.e., phonemic features of words, appear easy to retain for normal children while these same features are difficult for reading disabled children to retain (Norman, 1976). This again may indicate the nonmeaningfulness of this aspect of language for some poor readers. Tallal and Piercy (1974) investigated auditory perception in aphasoid and dyslexic children and found both groups inferior to controls in perceiving and articulating speech sounds with rapidly changing acoustic spectra. Both groups evidenced difficulty in responding correctly to rapidly presented speech sounds. While the groups had no difficulty distinguishing long vowel sounds, stop consonants such as "ba" and "da" which have a transitional component lasting only 40 msc. were beyond the capabilities of both dysphasic and dyslexic children. However, if these sounds were stretched to 95 msc. through the use of a speech synthesizer, the phonetic discrimination of the experimental groups matched that of the controls. Since auditory perception is by its nature sequential, deficits in the ability to perceive rapidly presented speech sounds has been thought to reflect an underlying sequencing deficit (Poppin, et al., 1969). Tallal's results, however, support the contention that a sequencing deficit appears secondary to a difficulty in the perception of some aspects of speech sounds (Tallal and Piercy, 1974; 1976).

Much evidence supports the contention that working memory for both reading and listening may rely on the ability to phonetically recode the information to be retained (Shankweiler, Liberman, Mark, Fowler and Fischer, 1979; Baddeley, 1966; Conrad, 1964, 1972; Conrad and Hull, 1964; Hintzman, 1969). Whether the items to be remembered were letters, words or syllables, the studies consistently demonstrated that confusions in short-term memory were greater for phonetically similar items than for those in which similarity was either semantic or visual. Moreover, even when the stimuli were pictured objects rather than linguistic items, there is evidence that these were phonetically rather than visually coded in memory (Conrad, 1972). Shankweiler et al. (1979) reported striking differences in the ability to phonetically recode information, between good and poor beginning readers. While allowing that poor readers might simply be evidencing deficient rehearsal strategies, the researchers suggested that underlying slow ineffective rehearsal might be their poorer access to a phonetic code or their access to a "degraded phonetic representation" (Shankweiler et al., 1979, p. 542). The primary problem, they suggested, was one of the availability of a phonetic representation and not rehearsal per se. The study suggests indirect support for the conclusions expressed by Bradley and Bryant's (1978) investigation which found poor readers deficient in the ability to categorize, or organize sounds within words, i.e., the children were unable to identify target nonrhyming words from a series of predominantly rhyming words.

The reading difficulties of some children may reflect underlying disruptions in the processing in one or more of the subsystems of language, i.e., phonological, syntactic or semantic. In terms of attention, the research suggests that either too much or too little effort would be expended upon the weak system. Under these conditions, Kahneman's theory would suggest that concurrent processing of the language components could not take place.

The implication as concerns the reading process is that comprehension may be dependent upon the integration of components which have been developed to an automatic level of response. Conversely, reading disability may be reflective of the inability to automate components as a result of the failure to establish inner representations of language structures consistent with those encountered in a given reading. One might then expect that the consequent partial processing would disrupt the necessary integration of components and result in a loss of reading comprehension.

Thus, this thesis takes the position that such access to the various components of language processing is of cardinal importance in establishing automaticity in code breaking skills for it is in the acquisition of these automatic skills that dyslexic children appear to be most deficient (Bannatyne, 1971).

D. The Arbitrary Demands of Script

This position sees reading disability occurring as a result of the failure to integrate the language components as they are represented in script. An apparent contradiction is evident in this argument. If it is true that reading disabled children are not able to integrate language components, why is this not apparent in their spoken language? Wiig and Semel (1973) suggest that school age children tend to use only those language structures with which they are proficient. Consequently they appear to be processing language competently. These difficulties are more often apparent in their poor comprehension of verbal instructions and consequent low school achievement. In response to this, it is a commonly held view that the language of instruction be appropriate to the linguistic abilities of the student. It is evident then that these children are able to integrate skills, albeit at an immature level. The difficulty, with respect to reading, is that script is arbitrary in determining the proficiency level at which language components must be integrated. In this light, reading disability may be defined as the failure to integrate language components at the level demanded by script.

The implications as concerns remediation are clear. Component language skills must be developed at the language level before they will be integrated at the reading level. This view takes the position that remediation should take place at the language level concurrent with accommodation to weak skill areas at the reading level. Therefore, reducing the demands of script to accommodate one or more skill areas, i.e., vocabulary, syntax, or segmentation skills, should result in integrated reading at this adjusted level.

Summary of Research

The introduction of this investigation evidences strong support for a language deficit hypothesis concerning the etiology of reading disability. However, given that reading disability may occur consequent to language disorders, there still exists the problem of determining those aspects of language which may underlie the reading process.

The survey of the literature reviewed examines this question from the perspective of the research concerning the correlation of written and spoken language, as observed in both language processing and that involved in reading. The normal reading process as defined by Strang (1969) involves three components: (a) to decipher the author's words, (b) to associate these words with meaning gained from linguistic and social experience, and (c) to appraise, modify and express ideas gained through reading. Such a view suggests that reading is primarily a meaningful linguistically oriented activity. Shankwieler and Liberman (1976) describe the reading process as requiring the modification of the speech system to accept optical information. They support this view in their analysis of script-language contact. Reading is suggested to require the recognition of phonemic, syntactic and semantic information as it is represented in script.

A closely related area of research is concerned with the type of cognitive processing which underlies fluent reading. Luria (1973) suggests that functionally separate systems of speech and/or language are simultaneously processed in the brain. As in the processing of complex language, good readers appear to be able to attend to the phonemic, syntactic and semantic aspects of script simultaneously.

Kahneman (1973) suggests that man has limits to his attentional capacity. He has therefore concluded that the ability to perform several acts concurrently depends upon the attentional demands of each individual act. The relationship between attentional allocation and automatic processing is so strong that LaBerge (1975) postulated that automaticity develops through the gradual elimination of attention.

Support for the automatization of reading skills is suggested by two models of the reading process (Guthrie, 1973), which contrast the degree to which reading skills are integrated in good versus poor readers. The researcher argues that good readers appear to demonstrate highly integrated skills, wheras reading disabled children typically demonstrate nonintegrated or fragmented skills. This position finds support in a developmental study of reading acquisition (Doehring, 1976). The researcher found that skills which were originally mediated by the speech system, i.e., early reading skills, became at an advanced level overlearned to the point that they had become automatic. The beginning reader may.

be separately processing different aspects of script. Early reading stages may then be dependent upon the ability to retain some aspects while processing others.

The overlap of mnemonic and attentional mechanisms is taken into account by Craik and Lockhart (1972) who suggest that the degree to which information is retained is dependent upon the depth to which the information was originally processed. Since meaningful information is processed to a greater depth than less meaningful information it is better retained. Researchers also suggest that attention to a stimulus is in turn dependent upon the compatibility of such stimuli with existing mental representations of these. If no representation exists, the item may be beyond the attentional awareness of the child (Sokolov, 1960: Levine, 1976).

These positions are consistent with the results of the Tallal and Piercy (1974) study which demonstrated that apparent differences in sequential memory for a series of speech sounds, between normal and dyslexic children, could be eliminated. It was demonstrated that the dyslexic children were unable to register certain sounds of 45 msec. duration. When these sounds were stretched to 95 msec. through the use of a speech synthesizer, the children were able to register and remember them. These positions provide explanation for Doehring's (1976) observation, that poor readers may be unable to automatize their component reading skills.

This review of research has included a survey of studies which investigated the effectiveness of remedial procedures currently employed with respect to learning disability (Arter and Jenkins, 1979). These researchers concluded that neither attempts to remediate weak underlying abilities nor procedures which gear instruction to the stronger modality have resulted in improvement in the majority of the studies surveyed. While the methods are theoretically tenable, Newcomer et al. (1975) suggest that the wrong skills are being remediated. Taken together with Tallal and Piercy's results, poor remedial outcomes may occur consequent to the attempt to provide practice in skills for which the student has a weak or absent mental representation. Conversely, such children may profit from approaches which promote the integration of reading skills through lessening the demands of certain aspects of language-script correspondence. This is what the study conducted attempted to do.

CHAPTER III

Rationale for the Study

This study takes the position that reading is primarily a linguistically dependent process and as such, rests upon an adequate representation of speech and language structures which are compatible to script equivalents. Shankweiler and Liberman (1976) suggest that phonemic, syntactic and semantic components of language have direct representation in script. Research findings reviewed in this study have encompassed difficulties in the above aspects of script and/or language contact. As yet, however, no definitive data exists which gives these particular functions etiological importance with respect to reading disability (Vellutino, 1978).

With respect to the reading process, reading acquisition would appear to involve the gradual integration of component skills. Such integration suggests that fluent reading involves simultaneous processing of these skills. Kahneman (1973) has suggested that the ability to perform several mental activities concurrently depends upon the effort involved in performing each of these activities in isolation. Doehring (1976) suggests that the degree to which component reading skills become integrated is dependent upon the extent to which component reading skills have become automated. Doehring's investigations concerning the acquisition of reading skills indicate that beginning readers demonstrate independent skills which appear to be mediated by the speech system (Doehring, 1976).

Advanced reading required the interdependence of component skills. Research related to the attentional components of the reading process imply that the failure to automatize component reading skills may be causal to reading disability. This position suggests that reading disabled children may be unable to process one or more aspects of language as represented in script. With respect to this latter point, Craik and Lockhart (1972) take the position that an item must be meaningful to be registered in attention. Only meaningful items will be remembered. Other researchers (Sokolov, 1963; Levine, 1976; Tallal and Piercy, 1974) suggest that attention to incoming information is dependent upon the compatibility of such stimuli with existing mental constructs or representations of these. If no mental representation exists, the information may be beyond the attentional awareness or meaningful level of the child. This suggests that failure to automatize some skill component may be an indication that it is not being learned because it is not being processed. It is doubtful that practice in deficit underlying skills would produce an improvement under these conditions.

Briefly mentioned in the review of research is the observation that underlying language difficulties may not be readily apparent in the speech of children because they customarily use only those linguistic structures with which they are competent (Wiig and Semel, 1973). This implies that the children are able to concurrently process information from language systems, albeit at an immature level. Difficulties arise in the educational setting when verbal instruction is delivered at a level beyond the language capacities of the child. Thus it is a current teaching philosophy to match instruction to the verbal abilities of students. Unlike the options available in the oral speech situation, the constraints of written language arbitrarily determine the level at which children must process information. This implies that integration adequate for processing at the oral level may be inadequate at the level required by script.

A basic rationale of this study is that reading disability may best be viewed as a failure to meet the linguistic demands inherent in script. Such failure to process adequately one or more interdependent components would prevent the acquisition of reading skills and result in poor reading comprehension. Such children, so afflicted may then profit from applications which promote the integration of reading skills through lessening the linguistic demands imposed by language structures as represented in script.

Objectives of the Study

A preliminary objective of the study will be to investigate differences in language ability between good and poor readers. Shankweiler and Liberman (1976) contend that language is directly represented in script with respect to lexical, syntactic and phonetic structures. Thus the dimensions selected for the evaluation of language skills are objective measures of: (a) vocabulary (lexical awareness), (b) the expressive ability to manipulate syntactic structures of the language (syntax), and (c) receptive syllabication awareness (phonology).

A second objective of the study is based upon the assumption that component reading skills must be integrated in order that comprehension take place. Assuming that linguistic skills, i.e., phonological, syntactic and semantic, underlie reading skills, the study will assess the effect of providing the reader with textual materials altered to compensate for a weak skill area. For example, a format may be reduced in syntactic complexity to accommodate a child with poor syntactic awareness.

A third objective of the study will be to determine if patterns of language abilities, found in the poor reader group, are reflected in the performance of such students on readings which have been simplified with respect to a specific language area. The assumption is that children selectively impaired in the same language skill for which the reading compensates will demonstrate reading comprehension ability commensurate with able readers of the same grade and age. This is assumed to result from the consequent integration of reading skills provided by reducing either the syntactic or phonologic requirements of a grade level reading. Conversely, children randomly assigned to a version of the test which compensates for a skill with which the child is proficient should demonstrate no improvement in reading comprehension.

Definitions of Terms

Some explanation of the terminology which will be used in this study may be helpful at this point:

Good Reader	May also be referred to as an average or fluent reader. A subject who is reading at his or her grade level or better as measured by the *Schonell Silent Reading Comprehension Test A.*
Poor Reader	A subject who is reading at a level 1½ to 2 years below his or her grade level as measured by the *Schonell Silent Reading Comprehension Test A.*
Format Reading	May refer to all or any of the three versions of a silent reading comprehension test. Format A is an unaltered version of a test adapted from the *Reading 360* series. It is estimated to be representative of a grade six eight month level of difficulty. Format B is the same test in which the text has been reduced in syntactic complexity. Format C is identical to the A Format with the exception that all words of more than two syllables are hyphenated, i.e., syllabicated.
Responder	A reader who achieves a score of 70 percent or better on any format of the adapted

Reading 360 comprehension test. This cutting score was arbitrarily chosen as indicative of low average reading ability at the grade six level, i.e. Book 12. The original, Informal reading inventory (*Reading 360*) instructions suggested a minimum of 75 percent as indicative of the ability to undertake more advanced instruction, i.e., grade seven, Book 13. This study takes the position that poor reading comprehension occurs consequent to the inability to integrate reading/language skills. The term *responder* includes both good and poor readers. The latter group are presumed to increase their reading comprehension because a format compensated for a weak skill area, therefore resulting in an integration of reading skills.

Nonresponder A reader whose reading comprehension is not improved by the linguistic compensation afforded by the format randomly assigned. This is measured by a score of 69 percent or less on the *Reading 360* comprehension test. As concerns poor readers, the format compensation has not improved reading comprehension through the integration of skills.

Syntactic Ability	The ability to manipulate the meaningful order of words, i.e., manipulate language structures
Syllabication Ability	The ability to perceive and differentiate syllables in orally presented words. Also, the ability to count syllables.
Vocabulary Ability	A measure of the child's receptive vocabulary of standard English words. Used in this study as a control measure. Vocabulary is held constant across Formats A, B and C.

Hypotheses

The objectives of this investigation have resulted in the following hypotheses concerning the relationship between linguistic competence and reading ability:

H_1: Good readers will achieve significantly higher scores than poor readers with respect to linguistic abilities as measured by: (a) *The Peabody Picture Vocabulary Test*, (b) *The Hunt-O'Donnell Experimental Measure of Syntactic Ability*, and (c) *The Listening for Syllables Test.*

H_2: The effect of linguistically simplified format readings, i.e. B (syntactically reduced) and C syllabicated) will be to increase reading comprehension scores for the poor reader group to a level undistinguishable from good reader controls.

H_3: Poor reader responders to Format B will demonstrate significantly lower syntax scores than good reader responders to all formats.

H_4: Poor reader responders to Format C will demonstrate significantly lower syllabication scores than good reader responders to all formats.

H_5: Poor reader nonresponders will demonstrate significantly lower vocabulary scores than those of good reader responders to all formats.

CHAPTER IV

Design and Methodology

The Problem

This study proposes to assess the effects of particular language skills as they relate to the performance of good and poor readers on a comprehension test. The dimensions selected for the evaluation of language skills are objective measures of: (a) syllabic awareness, (b) vocabulary awareness, and (c) the ability to manipulate syntactic structure.

The study further proposes to investigate the importance of the integration or interdependence of reading/language skills which presumably underlie proficient reading. In this regard, the study will assess the effect of providing poor readers with textual material which compensates for a weak skill area. The research has suggested that weak ability in one or more of the language skills would result in a breakdown of integrated or simultaneous processing, and therefore poor reading comprehension. Conversely, manipulated text which allows integrated processing should result in immediate gains in reading comprehension for poor readers. Good readers should be unaffected by the structurally altered text, since they presumably possess integrated reading skills.

In order to assess the effect of such linguistic manipulations, a reading comprehension test was constructed in three versions or formats: Format A is a reading selection which is unaltered and is representative of a typical classroom reading for grade six. Format B is the same selection reduced only in syntactic complexity. Format C is identical to Format A with the exception that words are syllabicated, i.e., syllables are hyphenated. Vocabulary is unaltered across the formats.

The Sample

A total of 102 teacher-selected students from nine elementary schools in the Edmonton Public System were screened on reading ability, IQ, age and grade. All of the students were currently attending regular grade six classes. The majority of poor readers had received resource room assistance in reading throughout grades one to five. Many of the poor readers were being considered for special programs at the junior high school level, which would not require proficient reading.

The Schonell Reading Test screen yielded a control group of 32 grade appropriate readers with a mean reading score of 6.9, and a group of 52 retarded readers whose reading grade mean was 4.9. The standard deviation of the combined sample was 1.16. The IQ range, as measured by the *Canadian Cogniture Abilities Test* was IQ 85 to 130. The criterion for acceptance was that either the Performance or Verbal IQ be a minimum of 85 with neither IQ exceeding 130.

The mean Verbal IQ for the poor readers was 92.23 and the mean performance IQ was 101.345. For the average readers, mean Verbal IQ was 106.84 and the mean Performance IQ was 108.06. The mean ages for good and poor readers were 12.06 years and 11.89 years respectively.

Experimental Procedure

All of the subjects were assessed on three language measures: (a) *The Hunt-O'Donnell Syntax Measure*, (b) *The Peabody Picture Vocabulary Test*, and (c) *The Syllable Listening Test*. The students were then randomly assigned to one of three versions of a reading comprehension test excerpted from book 12 of the Ginn *Reading 360* Series. The original version, an informal reading inventory had been altered to the following formats:

Format A: unaltered original reading selection
Format B: syntax reduced text
Format C: syllabicated text

The initial data analysis, a three-way analysis of variance, was carried out utilizing eight dependent variables. The factors were: Reading Ability (good reader-poor reader)X Formats (A, B, C) X Level of Response (high score i.e., 70% or better; integrated reading response) or (low score i.e.,69%; non-integrated response). The dependent variables were as follows:

1. Vocabulary Age (Peabody Picture Vocabulary Test)
2. Chronological Age
3. Syllabication Score (Syllable Listening Test, a criterion test developed for this study)

4. Syntax Score (The Hunt-O'Donnell Experimental Test of Syntax Ability)
5. Grade level Reading Scores (Schonell Silent Reading Comprehension Test A)
6. Verbal IQ (The Canadian Cognitive Abilities Test)
7. Performance IQ (The Canadian Cognitive Abilities Test)
8. Format Reading Comprehension Scores (Ginn Reading 360 Informal Reading Inventory adapted)

Instrumentation

A. *The Canadian Cognitive Abilities Test (C.C.A.T.)*. The Canadian Cognitive Abilities Test (1973) is a group intelligence measure which is administered routinely to all students in the Edmonton Public School System. Most of the students who participated in the study had been tested in November, 1979, although a few of the children had been assessed the previous year.

The C.C.A.T. is composed of three batteries which assess the individual's ability to reason using different kinds of materials. Each battery emphasizes one particular type of symbol--the Verbal Battery, verbal symbols, the Quantitative Battery, numerical symbols; and the Non-Verbal Battery, geometric and figural symbols.

The present test has evolved from the *Canadian Lorge-Thorndike Intelligence Tests*, and was normed jointly with the *Canadian Tests of Basic Skills (C.T.B.S.)* (1973). Thus norms for the C.C.A.T. are based on the same students which were used to norm the achievement test battery. This norming group was drawn from all provinces in Canada and also the Yukon. It is representative of English-speaking children from both urban and rural centres. The complete series covers the grade range from the second half of kindergarten to grade nine.

Five types of norms are provided for the interpretation of scores: (a) standard scores by age, (b) percentiles by age, (c) stanines by age, and (d) percentiles and stanines by grade. The present study employed standard age scores (SAS) from both the Verbal and Performance batteries. The Standardized Age Score is a normalized scale score in which the average score for each age group on each test battery is set at 100 and the standard deviation is set at 16. For any age group, a given numerical value has the same meaning in terms of standing relative to age group. Therefore, the SAS scores have the same statistical property as a deviation IQ.

The Standard Error of Measurement on each of the three batteries is approximately 3.5 score points. Thus the band includes plus and minus two times the Standard error on either side of an obtained SAS. A band of this width will include the true score about 95 percent of the time. Although they measure distinct abilities, the three batteries that make up the series have a good deal of overlap and can be thought of as having a common cognitive factor, i.e., G factor. Reliability coefficients at each grade level are .90 (K-R_{20}).

No data is reported in the manual with respect to concurrent validity with other measures of intelligence. The authors do however, report correlations between (C.C.A.T.) standard age scores and grade equivalent scores on the (C.T.B.S.). At the grade six level, the correlation between the verbal battery and reading ability is .78. The correlation between the nonverbal battery and reading ability is .59.

Predictive validity is not well demonstrated relative to achievement. Further, the authors caution that low scores on the verbal battery for students who are poor readers, or who are bilingual or have poor command of English should not be accepted at face value, since subjects are required to read on this battery. Because the present study is concerned with the language characteristics of poor readers, a rather wide range of IQ values was deemed appropriate. In addition, it is important that the sample be representative of poor readers as they actually exist in the classroom so that the results of the study are applicable to this group.

B. *The Hunt-O'Donnell Experimental Measure of Syntactic Development* (1970). This instrument was originally developed by Dr. Roy O'Donnell (1965-1966) and was employed by Hunt (1970) in an experimental study which investigated the syntactic changes in written expression of school children at successive grade levels. The basic thesis of the study was that as school children mature mentally, they tend to embed more and more of their elementary sentences within more complicated forms (Hunt, 1970). While it is possible that this behavioral tendency is simply the outcome of stylistic imitation, Hunt suggested that ". . .as the mind matures it organizes information more intricately and so can produce and receive more intricately organized sentences" (Hunt, 1970, p. 58). He draws support for this idea from Miller's (1956) theory of "chunking" or grouping bits of information in order to extend memory span (Hunt, 1970).

The instrument, itself, consists of 32 short sentences of connected discourse. These sentences are shorter than those normally spoken by kindergarten children and average about four and one third words (Hunt, 1970). Each sentence is a single clause. These very short sentences were deliberately chosen to provide opportunities for the student to use sentence-combining transformations. Previous studies had suggested that children learn to use larger and larger chunks of information as they progress through school (Labrant, 1933; O'Donnell et al., 1967; Hunt, 1965). The same tendency appears in children's speech, at least up to the seventh grade (Hunt, 1970). The testing procedure requires the subject to rewrite the passage in a better way. Hunt employed five different scoring methods with which to investigate syntactic development. Only one of these, clause length, will be used in the present study. The researcher suggests that to score a paper for clause length is the most easily employed and practical of the scoring methods.

No one commonly accepted criterion measure of syntax ability presently exists with which to determine the concurrent validity of this test. Hunt's findings, however, speak for the construct validity of this experimental measure. The explanatory concepts concerning syntactic maturation appear to account to some degree for the performance on this instrument. With respect to clause length, Hunt found that this measure was closely related to age and ability groupings. At every grade interval, i.e., two years, there was a significant increase in clause length and among the ability groups there was also an increase. Within every grade, the differences between the high and low ability groupings was significant at the 0.05 level by the *Wilcoxen Rank Sum Test*. An analysis of variance indicated significance for grade and for ability, but not for the interaction of grade and ability. The *Newman Keuls Test* indicated the difference was significant between each pair of grades. Hunt suggests that clause length, as measured by this instrument was an extremely sensitive measure of some factor closely related to both chronological age and mental ability (Hunt, 1970).

A clause is defined here as any expression which contains a subject (or coordinate subjects) and a verb (or coordinate verbs)(Hunt, 1970). The passage is scored by counting the number of clauses and the number of words and by dividing the latter by the former to get mean clause length. This score is used as a measure of the writer's maturity. The writings are screened to exclude extraneous, unintelligible or inaccurate passages. Where these are found, the whole sentence is deleted. Passages such as the following are judged to contain inaccurate or unintelligible material:

> The luster is silvery and come in many forms. They take the mass substances out by using filters then they put it in several other substances because a liquid remained. They grind it and put it in remove mass with use filters.

Passages such as the following are judged extraneous:

> This is a nonfiction story about aluminum. This metal, like I said before, has many uses and comes in varied forms. (Examples from Hunt, 1970, p. 13).

The advantage of this instrument over the measuring of free writing is the speed with which the instrument can be administered and scored. At any grade level, it is almost self-administering and can be completed in a class period of 40 minutes (Hunt, 1970). The disadvantage of the instrument is that it is not known if students would be ranked in the same order of syntactic maturity if they were evaluated by measures of several thousand words of their own free writing on chosen topics (Hunt, 1970). In addition, minimal reading ability is required in order to undertake the test. For this reason, the passage was read orally to the students who participated in the present study. Students were also given assistance in reading, if required, during the administration of the test (See Appendix A).

The instrument was administered to more than a thousand students in Grades 4, 6, 8, 10 and 12 in the Schools of Tallahasse Florida. The investigators then selected from each grade, 50 students who would represent an approximately normal distribution of academic ability. This distribution was made on the basis of scores of standardized tests which had already been administered to the children. The 50 students from each grade were further subdivided into three ability groups of approximately equal size according to their scores on the standardized tests. Hunt (1970) reports that the actual mean scores of the three groups for each grade did not differ significantly from what they would have been in a normal distribution. Results for two groups of adults were also tabulated in order to determine if tendencies manifested by school children would be further developed in adults (Hunt, 1970). The experimental instrument yielded significant differences at every two-year interval from grade four to grade 12 and for the adults (Hunt, 1970). Hunt suggested that scores obtained from his study be used as approximate norms for syntactic maturity.

Although the reliability of the instrument was not checked by administering it to students a second time, a second similar instrument was administered within one day of the first test. The clause length scores of 50 fourth graders on the two tests correlated .55; a correlation of .23 would have been significant at the .05 level. The clause length scores of the middle group of students in all five grades on the two instruments correlated .73.

In summary, Hunt's test appears to be appropriate for use in the present study because of the commonality of its theoretical underpinings with the current investigation and because of the lack of syntax measures appropriate for school age children and/or adaptable for group administration.

C. *The Schonell Silent Reading Comprehension Test A*. This instrument is one of a group of academic attainment measures, developed by F. Schonell in the late thirties. The tests were first published in Schonell's Backwardness in the Basic Subjects (1942).

Two factors mitigate against the test. First the norms may not be appropriate for use with the population of Canadian students. The original norming group of school children was drawn from a school population of 15,515 London school children. The schools chosen were representative of a wide range of social and vocational levels. The norms of test A were based on 1865 cases (Schonell, 1948). These were revised in 1950.

Another factor is that although the latest version of the tests were published in 1969, the authors have as yet reported no data concerning the validity with concurrent measures of reading ability (Buros, 1972). Therefore, although the instrument appears to be a sensitive discriminator of reading ability levels, the stated age and grade scores may or may not concur with those of similar measures.

Silent Reading Comprehension Test A is a timed comprehension test consisting of 18 short paragraphs with accompanying questions. It yields a reading-age score, i.e., years and months. Derived scores may also be expressed in years and months of years (tables provided) or as grade scores. The latter are estimated by subtracting five years from the reading age. The test was used in the present study as a quick screen to establish relative reading levels for the sample group. A copy of the test may be found in Appendix E.

D. *The Peabody Picture Vocabulary Test Form A.* This is an untimed test designed to provide an estimate of a subject's verbal intelligence through measuring his hearing vocabulary (Peabody Manual, 1965). Although the Peabody yields a score called an IQ, it more properly should be considered a test of a child's receptive vocabulary of standard English words (Hammill and Bartel, 1975). The test was standardized on 4012 cases involving the age range from 2 to 18 years. At the lower pre-school and elementary levels, the test was individually administered to subjects. At the upper elementary and high school levels (ages 9 through 18) the PPVT was administered as a group test by the use of photographic slides of the series of plates, a semi-automatic projector, a screen and an especially designed answer sheet (Peabody Manual, 1959). Prior to adopting this procedure, an experiment was conducted to determine if scores on the PPVT would differ significantly under group or individual administrations. No significant differences were found (Norris, Hottel, and Brooks, 1960).

The test yields a mental-age score, a standard score (intelligence quotient) and percentile equivalent scores. Two parallel forms of the test are available, i.e., Form A and Form B. An IQ of 100 was arbitrarily assigned to the mean raw score for each age group and the standard deviation set at 15 IQ points (Peabody Manual, 1965). The deviation IQ scores were only extended out three standard deviations and therefore range from 55 to 145. Extrapolated norms are provided beyond these limits.

PPVT scores correlate with '60 Binet mental ages from 0.82 to 0.86 with a median of 0.83. PPVT IQ's exceeded '37 Binet IQ's by an average of six points (Peabody Manual, 1965). "Congruent" validity involving the PPVT and the *Weshcler Intelligence Scales* (WISC) are reasonably close to those using the Binet. The PPVT and Weshcler IQ values appear to be very similar with a tendency for the PPVT (IQ's) to be one or two points higher than the Weshcler (IQ's).

"Concurrent" validity, the extent to which PPVT scores correlate positively with other measures of scholastic achievement, is not well-demonstrated. Correlations with standardized achievement tests tend to fall in the area of 0.50. Binet correlations tend to run 0.15 points higher than for the PPVT, and Wechsler scores 0.10 points higher (Peabody Manual, 1965). This might well be anticipated since the PPVT provides a smaller and more narrow sampling of intellectual behavior (Peabody Manual, 1965).

The few studies available which have investigated "Predictive validity" demonstrate positive but low correlations between the PPVT and achievement test scores obtained some time after the PPVT administration. Klause and Starke (1964) found PPVT scores obtained at the beginning of the grade one school year to correlate with *Metropolitan Achievement Test* scores: 0.39 (Word Knowledge), 0.35 (Word Discrimination), and 0.39 (Reading) taken at the end of the school year. Moss (1962), with retardates, found a correlation of 0.22 with *Metropolitan Achievement Test* reading scores and 0.43 with arithmetic scores on the same test. The manual suggests that since these studies were conducted on children at the beginning stages of reading visual discrimination and other factors were probably more important (Peabody Manual, 1965).

Alternate form, i.e., A or B, reliability coefficients (the degree to which a subject scores consistently on the test) were obtained by calculating Pearson product-moment correlations on the raw scores of the standardization subjects for both forms A and B. Correlations ranged from a low of 0.67 at the six-year old level to a high of 0.84 at the 17 and 18-year levels, with a median of 0.77. The standard error of measurement for IQ scores ranged from 6.00 to 8.61, the median being 7.20 (Peabody Manual, 1965).

The present study employed the PPVT as a measure of receptive vocabulary. The mental-age scores were chosen as being the most comparable in relation to the other measures used in this investigation. Since, as previously stated, the upper elementary subjects of the original norming sample were group tested, the PPVT was adapted to group administration for the present study. The plates were copied on separate sheets of paper and these collated into individual booklets for each student. In order to allow for a wide range of abilities, the test was begun at plate no. 50, the seven to nine-year old level, and continued to plate no. 100, i.e., the eighteen-year old level.

The students were instructed to place a checkmark on the correct picture. They were also told that towards the end of the test, they might know few of the word-meanings, but to attempt these anyway. While the individualized test takes between 10 and 20 minutes to administer, the group administration took from 20 to 30 minutes. It was felt that preparing individual booklets for each child would overcome the difficulties of using an answer sheet, i.e., loss of place, etc. Each word was read twice to ensure that the students heard the words correctly. Booklets were scored using the standard score sheet for form A, and carried out as per instructions in the manual.

E. Adaptation of a Ginn *Reading 360* informal reading inventory. The experimental reading test was adapted from the *Informal Reading Inventory* of the Ginn *Reading 360* series and had been excerpted from the book 12 test, i.e., approximately grade six level. This selected reading was then rewritten in two additional versions:

1. Format A is the unaltered version of the excerpted reading.

2. Format B was rewritten so as to reduce the syntactical complexity of the text.

3. Format C was altered in that all words of more than one syllable were hyphenated to visually break up the word for the reader (See Appendix A).

The Botel-Granowsky formula for measuring syntactic complexity (1972) was applied to Format A in order to obtain an estimate of the syntactic complexity of an average grade six reading selection. Format B was then developed by means of the same formula to represent a syntactically reduced form. In the syntactic Complexity Formula, analysis of language structures is based on transformational-generative grammar theory, language studies investigating the frequency of usage of structures in the language of children, and the intuitions of the authors where experimental data had yielded inconclusive results (Botel and Granowsky, 1972). The formulae consists of a list of weightings (from 0 to 3) assigned to syntactic structures. The syntactic complexity of any passage or sampling of sentences is the arithmetical average of the complexity counts of the sentences evaluated. A copy of the syntactic weighting is to be found in Appendix A. The syntactic complexity of the original reading selection, i.e., Formula A, was 3.8. The greatest reduction obtained for Format B, without eliminating information in the selection was 1.27. This reduction resulted in shortened sentences as well as a reduction of complex grammatical structures as the following excerpts demonstrate:

> Format A: Stacking their snow shovels,
> they made for the vacant lot
> beside the "empty". . .
>
> Format B: The boys stacked their shovels.
> They made for the vacant lot.
> The lot was beside the "empty"
> . . .

The syllabicated format, i.e., Format C is identical to Format A, with the exception that words of more than two syllables are hyphenated as follows:

> Format C: Stack-ing their snow shov-els,
> they made for the va-cant lot
> be-side the "emp-ty". . .

The students were randomly assigned to one of the three formats of the comprehension test. Questions for the test were adapted from those used in the *Reading 360* manual. Here the text was not altered but care was taken to ensure that both the questions and the multiple choice answers constituted easy reading. To further ensure that poor readers were not penalized by the unaltered nature of the question sheet, the questions and the choice of answers were read aloud to all students. Each question and choice of answers was repeated twice. Students were given as much time as they required to read the selection. They were instructed to turn their papers over when they were finished, and not allowed to refer to the selection when attempting to answer questions. No writing was required for this test. Students indicated their choice of answers with a checkmark.

F. Syllable listening test. This measure was developed specifically for use in this study since available instruments were either not suitable for group administration or contained vocabulary items deemed to be too difficult for this age group. Further, tests employing nonsense syllables were felt to be inappropriate in that it seemed likely that short-term memory variables might confound the results. Consequently, words of from one to five syllables were chosen from the vocabulary lists of several reading series currently being used throughout the school system. The attempt was made to choose high frequency words with which the students would be familiar. Thirty-three words were chosen. Three of these served as sample items to which the children responsed orally. The remaining 30 items required students to count the syllables in the orally presented words and indicate this by circling the correct number on an answer sheet provided for this purpose. A copy of this experimental measure may be found in Appendix A.

Collection of the Data

The test battery was administered during the last two weeks of April and the first week of May, 1980. Subjects were group-tested on the measures, all of which were administered in one 90-minute session at each of the schools. The sequence of the tests administered was randomized across schools so as to control for order effects. Within each of the nine schools, subjects were drawn from more than one classroom. The schools selected for participation in the study were widely located throughout the city and should therefore be representative of both good and poor readers as they are commonly found in somewhat typical classrooms in the Edmonton Public System.

CHAPTER V

Results and Discussion

A total of 84 grade six students from nine elementary schools in the Edmonton Public School System participated in the study. This chapter presents the results of this investigation.

As a check on selection criteria, a 2 (reading ability) X 3 (format type) X (response type) ANOVA was performed on the variables of verbal IQ, Performance IQ, reading comprehension, and age. The results of these analyses clearly differentiated the experimental poor readers group from the good reader controls.

With respect to IQ as measured by the *Canadian Cognitive Abilities Test*, good readers achieved significantly higher IQ scores than did the poor reader group. This was true with respect to verbal IQ scores ($F=32.4$, $p < 0.001$) and also for Performance IQ scores ($F=17.93$,$<$p 0.001). The differences were expected since both proficient reading and listening ability are required for this group administered test.

Good and poor readers were also differentiated with respect to their *Schonell Silent Reading Comprehension Test A* grade scores ($F=162.2$, $p < 0.0001$). Good readers were found to be significantly superior on this measure of reading ability. The good and poor reader groups were not found to be significantly different in age ($F=2.63$, $p > 0.05$).

Thus, good and poor readers are statistically different in performance.

Complete results of the three-way ANOVAs performed on the variables of IQ, reading ability and age may be found in Appendix B, Tables I, II, III and IV. Mean scores and standard deviations on the variables may be found in Table 1.

Table 1

Mean Age, IQ, and Grade Reading Scores for Two Reading Ability Groups

		Chronological Age	C.C.A.T. IQ		Schonell Reading Grade Score
			Verbal	Perf.	
Good Readers	Means	11.89 yrs.	106.8	108.0	Gr. 6.93
	S.D.	.51	12.88	9.74	.70
Poor Readers	Means	12.08 yrs.	99.0	97.5	Gr. 4.89
	S.D.	.64	9.6	13.72	.76

Five hypotheses were tested at the 0.05 level of significance. In the interests of clarity, the presentation of results for each will include both a restatement of the rationale for that specific hypothesis and a discussion in terms of the literature reviewed. The accumulation of inferences from all five hypotheses will then be summarized along with a discussion of limitations and implications of the overall study.

Hypothesis 1

The basic rationale for this study is that reading difficulties reflect underlying linguistic deficiencies. It is necessary, then, to establish that poor readers are, in fact, deficient in language abilities when compared to fluent-reader peers. Hypothesis 1 stated that good readers will achieve significantly higher scores than the poor reader experimental group with respect to linguistic abilities as measured by: (a) *The Peabody Picture Vocabulary Test*, (b) *The Hunt-O'Donnell Experimental Measure of Syntactic Ability*, and (c) *The Listening for Syllables Test.*

A 2 (reading ability) X 3 (format type) X 2 (response type) ANOVA was performed on each of the three linguistic measures. These analyses may be found in Appendix B, Tables V, VI and VII. The mean score differences between good and poor reading groups are stated in Table 2.

Table 2

Means on Language Measures

for Two Reading Ability Groups

		Vocabulary	Syntax	Syllabication
Good Readers	Means	14.42 yrs.	11.25 yrs.	27.56/30
	S.D.	2.40	1.76	2.45
Poor Readers	Means	12.62 yrs.	9.93 yrs.	26.73/30
	S.D.	1.95	1.76	3.76

As is evident, the good reader group outperformed the poor readers on all three measures. The differences were significant, however, only for the syntax and vocabulary scores. The groups were not significantly different with respect to syllabication ability. Hypothesis I therefore received only partial support in this analysis.

This unexpected result prompted the speculation that syllabication skills may best be viewed as reflective of abilities which may underlie, but which are not in themselves language variables.

Post-hoc analysis employing Pearson product-moment correlations among the measures revealed that syllabication scores were unrelated to either vocabulary or syntax scores. Further, this skill was unrelated to reading ability as measured by the *Schonell Silent Reading Comprehension Test A*. The ability was related only to achievement scores on the structurally altered readings (formats)($r= -.33$, $p<0.01$). In contrast, both vocabulary and syntax were found to be significantly correlated with the above reading measure ($r=.44$, $p<0.001$) and ($r=.32$, $p<0.01$) respectively. As might be expected, vocabulary and syntactic abilities were significantly interrelated ($r=.24$, $p<0.05$). The latter two abilities are clearly language variables, and to this extent Hypothesis I finds support in this analysis.

The poor readers in the present study demonstrated deficient language skills as compared to fluent readers. They were not deficient in syllabication ability which as measured by the

Syllabication Listening Test, does not appear to be a critical language component of the reading process at the grade six level. However, syllabication ability may play a more integral part during earlier stages of reading acquisition.

That syllabication skills are not fully representative of language ability is reflective of Francis' (1965) suggestion that the syllable is an intermediate strand of language structure between the lexico-grammatical system and speech. Unlike other aspects of speech, the ability to segment the sound stream is not in and of itself a meaningful process.

Strang suggests that reading involves both decoding and the anticipation of meaning with respect to the linguistic experience of the child.(Strang, 1969) The degree to which decoding skills such as syllabication are developed may then be dependent upon the extent to which words may be anticipated through knowledge of their existence in the oral vocabulary of the child. Words may also be anticipated from their use within the context of the sentence, i.e., their syntactic meaning.

This view finds support from Norman (1976) who suggested that decoding takes place only to the degree necessary to accomplish the recognition of meaning. Good readers, then, should be less dependent upon syllable decoding strategies in that these readers are able to extract meaning through their demonstrated superiority in both vocabulary knowledge and syntactic awareness. Norman (1976) suggests that English words are decoded typically by attending chiefly to either the initial letters or syllable and the final letters or syllable.

However, the order of attention favors the ends of words because the ends contain more meaning than do the middles. This implies that good readers extract the meaningful aspects of words at even the most basic level of reading, i.e., decoding. Conversely, some poor readers demonstrated high syllabication scores, perhaps suggesting that they are overreliant on decoding skills due to inadequate vocabulary knowledge and/or syntactic ability.

Hypothesis II

Hypothesis II stated that the effects of structurally altered formats, i.e., B syntactically reduced and C-syllabicated, would be to increase reading comprehension scores for the poor reader group to a level indistinguishable from the good reader control group. As is evident, the hypothesis was concerned with the effects on reading comprehension of reducing the linguistic demands of script. It was proposed that such reductions permit the integration of reading skills and would, thereby, result in increased reading comprehension. Of interest here is the degree to which such manipulations increase reading comprehension for those children whose reading scores on standardized reading tests indicate retardation, i.e., approximately two years, as compared to their age and grade peers.

In order to test this hypothesis, a 2 (reading ability) X 3 (format type) X 2 (response type) ANOVA was performed on the adapted Ginn *Reading 360 Informal Reading Inventory* measure. This analysis indicated a main effect for reading ability with respect to the combined results for formats A, B, and C ($F=3.85$, $p<0.05$). This result was expected since one of the formats, i.e., Format A had not been altered and should therefore prove difficult for poor readers. The analysis also indicated that high and low scores, which respectively should reflect integrated vs. nonintegrated reading skills were dependent upon which format the child attempted. This interaction was significant ($F=4.12$, $p<0.05$). The complete results of this analysis may be found in Appendix B, Table VIII. The mean reading scores for good and poor readers across Formats A, B, and C is graphically depicted in Figure 1.

In order to directly test Hypothesis II concerning the effects of individual formats, Hotelling t^2_2 tests for two independent samples were performed for each format over eight variables, i.e., vocabulary, chronological age, syllabication ability, syntactic ability, Schonell reading ability, verbal IQ, Performance IQ, and format reading scores.

A prior assumption concerning the effects of reducing the demands of script is that the original version of the format reading test is representative of a somewhat typical grade six reading selection. The results of the analysis for Format A (unaltered grade six reading) may be found in Table 3.

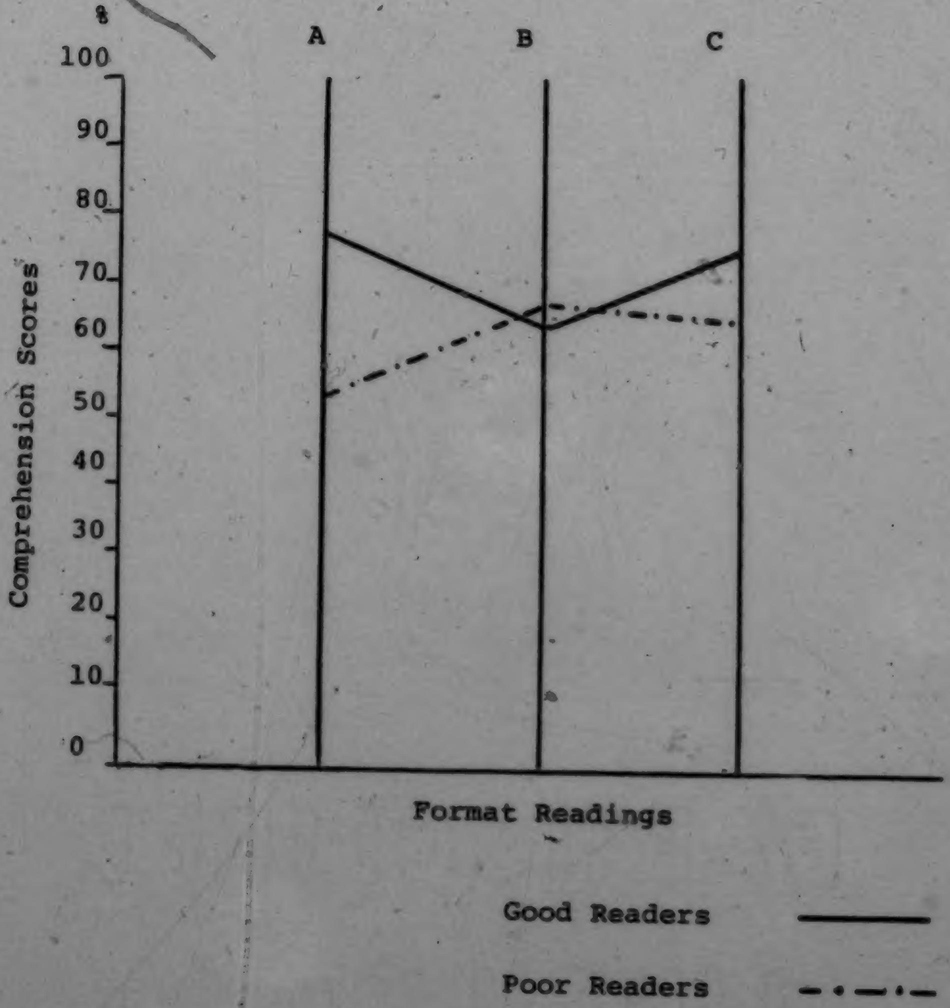

Figure 1: Comprehension Scores Across Formats A, B and C for Two Reading Ability Groups.

Table 3

Performance of Good and Poor Readers on

Format A

Variable	Tests for Each Variable				
	T**2	DF1	DF2	F	P
1. Vocabulary	7.832	8	15	0.667	0.712
2. Chronological Age	5.547	8	15	0.473	0.857
3. Syllabication Ability	8.010	8	15	0.683	0.751
4. Syntax Ability	5.688	8	15	0.485	0.849
5. Schonell Reading	80.573	8	15	6.867	0.001
6. Verbal IQ	14.678	8	15	1.251	0.337
7. Performance IQ	15.211	8	15	1.296	0.316
8. Format Reading A	30.123	8	15	2.567	0.055

T**2 = 201.798 DF1 = 8 DF2 = 15
F-ratio = 17.198669 Probability = 0.000004

n_1 = 12 = Good Readers n_2= 12= Poor Readers

As is evident from the Hotelling t^2_2 multivariate analysis, good and poor reading groups were significantly differentiated both with respect to their Schonell (actual reading ability) scores and their reading comprehension (Format A) scores (F=6.867, $p<0.001$) and (F=2.567, $p<0.05$) respectively. The students randomly assigned to this format were not differentiated with respect to age, IQ, or language scores. This was an expected result. Format A is representative of a typical classroom reading at the grade six level. Therefore it is expected that good and poor readers would be differentiated with respect to reading ability on this test.

The major concern, however, is with the effects on comprehension of altered format readings, i.e, B and C. With respect to Format B, the findings of the analysis indicate that again the groups were found to significantly differ in Schonell reading ability scores. Conversely the groups were not significantly differentiated with respect to their Format B comprehension scores. The results of this analysis may be found in Table 4.

Table 4

Format Reading Comprehension Scores
for Good and Poor Readers (Format B)

Variable	Tests for Each Variable				
	T**2	DF1	DF2	F	P
1. Vocabulary	2.396	8	21	0.225	0.982
2. Chronological Age	3.794	8	21	0.074	1.000
3. Syllabication Ability	1.795	8	21	0.168	0.993
4. Syntax Ability	4.426	8	21	0.415	0.899
5. Schonell Reading	51.198	8	21	4.800	0.002
6. Verbal IQ	10.610	8	21	0.995	0.468
7. Performance IQ	4.153	8	21	0.389	0.914
8. Format Reading B	0.024	8	21	0.002	1.000

T**2 = 93.449 DF1 = 8 DF2 = 21
F-ratio = 8.760809 Probability = 0.000033
n_1 = 10 = Good Readers n_2 = 20 = Poor Readers

As is evident, poor readers achieved significantly lower scores on the *Schonell Silent Reading Comprehension*

Reading Test A than those demonstrated by good readers (F=4.8,<p 0.002). Good readers were not differentiated significantly from poor readers with respect to performance on Format B which had been textually altered, i.e., reduced in syntactic complexity (F=.002, p>1.000). Although the good and poor readers were clearly differentiated as to their actual reading ability, the effect of the structurally manipulated format appears to have resulted in eliminating the differences in reading comprehension between the experimental and control groups.

The findings concerning Format C closely resemble those for the B format. This format was altered by syllabicating, i.e., hyphenating all words containing more than one syllable. Good reader controls were differentiated from the poor reader experimental group with respect to actual reading ability, as measured by the *Schonell Silent Reading Test A* but were indistinguishable with respect to Format C Comprehension scores (F=.141, p>0.996). These results may be found in Table 5.

Table 5

Format Reading Comprehension Scores

for Good and Poor Readers (Format C)

Variable	Tests for Each Variable T**2	DF1	DF2	F	P
1. Vocabulary	5.318	8	21	0.499	0.844
2. Chronological Age	0.029	8	21	0.003	1.000
3. Syllabication Ability	3.426	8	21	0.321	0.949
4. Syntax Ability	1.914	8	21	0.179	0.991
5. Schonell Reading	92.526	8	21	8.674	0.000
6. Verbal IQ	12.703	8	21	1.191	0.350
7. Performance IQ	2.094	8	21	0.196	0.988
8. Format Reading C	1.506	8	21	0.141	0.996

T**2 = 123.561 DF1 = 8 DF2 = 21
F-ratio = 11.583838 Probability = 0.000004

n_1 = 10 = Good Readers n_2 = 20 = Poor Readers

The above results indicate support for Hypothesis II with respect to the effect of Format C. The effect of this linguistically reduced reading test was to eliminate the differences in comprehension between good reader controls and the experimental group of poor readers.

Concerning the differences in language ability between good and poor reading groups, the results of the multivariate analysis performed for individual formats did not differentiate these sub-groups with respect to IQ, chronological age or language ability. This may be due to the small numbers in the groups analyzed. Concerning the language variables, differences in linguistic ability would tend to be averaged out in the poor readers group since both responders and nonresponders to the formats were included within this group.

In summary, while no effect on reading comprehension was demonstrated for unaltered Format A, these results suggest that the effects of Formats B and C were to eliminate the differences in reading comprehension between the control group of good readers and the poor reader experimental group. Within the poor readers group, the differential effect of format was somewhat dramatic. For example, poor readers who responded, i.e., benefited from Format B (syntax reduced) achieved a mean of 75.6 while nonresponders remained at 59.5 percent. With respect to Format C (syllabicated) poor reader responders achieved 81.4 percent on the test as opposed to 54.2 percent for nonresponders.

These outcomes demonstrate support for Guthrie's position concerning component reading skills, i.e., that fluent reading requires the integration of component skills. To the extent that the altered formats were successful in reducing attentional demands to specific skill areas, these results may be reflective of integrated reading.

One of the major postulates of this investigation was that an inner mental representation of a speech element is necessary for that element to be recognized and processed (Solokov, 1960; Tallal and Piercy, 1974). The reduction in the demands of script may have permitted processing at a level at which such inner representations are available. It was previously suggested that language deficient children tend to use only those linguistic forms with which they are proficient (Wiig and Semel, 1973). Therefore language difficulties are not always apparent in their oral expression. This assumption suggests that integration of language skills takes place at some level of linguistic competence. Since language components find direct representation in script (Shankweiler and Liberman, 1976), the reader is forced to integrate components at whatever level is demanded in script. These results suggest that such integration has taken place through reducing the linguistic requirements of script.

The results also lend some support to Doehring's suggestion that language abilities may underlie component reading skills. It remains to be established however that poor readers who profited from a specific format were in fact selectively impaired in that language ability for which compensation had been provided. The remaining three hypotheses are concerned with this question.

As indicated in a previous section, a student who achieved a score of 70 percent or greater on any format is termed a responder to that format. Conversely, a student for whom a specific format had no beneficial effect is termed a nonresponder. The latter is defined as a student who achieved a score of 69 percent or less on any format. The poor reader responders and nonresponders were compared to a control group of good readers who achieved a score of 70 percent or greater on any of the three formats, i.e., A, B, or C. The language skills of these able readers are presumed to be age and grade appropriate.

Hypothesis III

Hypothesis III states that poor reader responders to syntactically reduced Format B will demonstrate significantly lower syntax scores as measured by the *Hunt-O'Donnell Experimental Test of Syntax Ability*, than those demonstrated by good reader controls, i.e., responders to A, B or C. Restated, this hypothesis suggests that poor readers, who received a high score, i.e., above 70 percent on Format B will demonstrate significantly lower syntax scores than good readers who achieved above 70 percent on any of Formats A, B or C. Means on the three language measures were compared for the control group of good readers and the experimental group of poor readers, who achieved high scores on Format B. These may be found in Table 6.

Table 6

Mean Performance Scores of Format B Responders versus Controls on Three Language Measures

		Vocabulary	Syntax (Hunt-O'Donnell)	Syllabication (Listening for Syllables)
Controls n = 22	Mean	14.93 yrs.	11.52 yrs.	27.36/30
	S.D.	2.08	1.76	2.42
Responders to Format B n = 10	Mean	13.3 yrs.	8.9 yrs.	23.5/30
	S.D.	2.1	.46	5.17

Multivariate analysis employing the Hotelling t^2_2 procedure for two independent groups was performed over the three language variables: vocabulary scores, syllabication scores and syntax scores. The results of this analysis may be found in Table 7.

Table 7

Differences in Language Ability for Two Reading Ability Groups Responders to Format B

	Tests for Each Variable				
Variable	T**2	DF1	DF2	F	P
1. Vocabulary	4.183	3	28	1.301	0.293
2. Syllabication	8.468	3	28	2.634	0.069
3. Syntax	1.290	3	28	6.624	0.002

T**2 = 26.801 DF1 = 3 DF2 = 28
F-ratio = 8.338085 Probability = 0.000406

n_1 = 22 = Good Readers n_2 = 10 = Poor Readers

As is evident, poor reader responders to the syntactically reduced format were significantly less developed in syntactic ability than were the good reader controls ($F = 6.624$, $p < 0.002$). In terms of the research discussed in previous sections, children weak in syntactic ability at the language level may evidence poor reading comprehension as a result of being unable to process syntactic meaning at the level required by script. Conversely, they appear able to process this information in concert with other reading/language skills when syntactic requirements are reduced to their language ability level.

An interesting trend was evident for syllabication ability suggesting that these children may also have difficulty with word segmentation (Table 7). It was previously suggested that the ability to segment the sound stream is not in itself a meaningful process (Francis, 1965). The ability to syllabicate words may be more related to the cognitive propensity to chunk discrete bits of information into manageable units which can be held in short term memory (Miller, 1965). Syllabication ability as measured by the *Syllabication Listening Test* required the students to both identify and count the syllables in the orally presented words. Both auditory perception and verbal sequencing ability were task requirements which could have affected the test result.

The syntactically reduced version of the comprehension test was developed by using the Botel-Granowski formula (1972). A copy of this formula may be found in Appendix A.

The reduction resulted in an increased number of shorter sentences than those of the original version, i.e. Format A. Such reductions in the length of sentences might be expected to benefit children with short-term memory or verbal sequencing problems. Although Brown and Frazer (1964) suggested that syntactic development may be limited by immediate memory span, no trend was noted in the raw data to indicate that poor readers made more mistakes for five syllable words than they did for three syllable words. This suggests that perhaps some syllables did not register as discrete sound segments for some children. This view is consistent with that of Tallal and Piercy (1974) who suggest that sequencing deficits may be symptomatic of an underlying inability to register some aspects of speech sounds. Although not statistically significant, this trend suggests that children with sequencing deficits may also be limited with respect to their syntactic development. The hypothesis that poor reader responders to syntactically reduced readings would evidence significant deficits in syntactic awareness at the language level as compared to good reader responders, is supported by these results.

Hypothesis IV

Hypothesis IV states that poor reader responders to Format C will demonstrate significantly lower syllabication scores than will good reader responders to all formats. Means on the three language measures were compared for the control group of good readers and the experimental group of poor reader responders, who achieved above 70 percent on Format C. These may be found in Table 8.

Table 8

Mean Performance Scores of Format C Responders Versus Controls on Three Language Measures

		Vocabulary (PPVT)	Syntax (Hunt-O'Donnell)	Syllabication (Listening for Syllables)
Controls n = 22	Mean	14.93 yrs.	11.52 yrs.	27.36/30
	S.D.	2.08	1.76	2.42
Responders to Format B n = 10	Mean	13.49 yrs.	10.25 yrs.	24.4/30
	S.D.	1.96	1.86	1.73

The Hoteling t^2_2 procedure for two independent samples was performed over the three language variables in order to determine whether real differences in language ability existed between the control and experimental groups. The results of this analysis may be found in Table 9.

Table 9

Differences in Language Ability for Two Reading Ability Groups Responders to Format C

Variable	Tests for Each Variable T**2	DF1	DF2	F	P
1. Vocabulary	3.425	3	28	1.066	0.379
2. Syllabication	8.179	3	28	2.544	0.076
3. Syntax	3.485	3	28	1.084	0.372

T**2 = 10.615
F-ratio = 3.302368
DF1 = 3
DF2 = 28
Probability = 0.034675

n_1 = 22 = Good Readers

n_2 = 10 = Poor Readers

As is evident from the results depicted in Table 9, poor reader responders to the syllabicated C format were not differentiated significantly from good reader responders with respect to either vocabulary or syntactic ability. Poor readers did tend to evidence lower syllabication scores, however this difference did not reach significance (F= 2.544, $p > .076$). Therefore, hypothesis IV is not corroborated by these results.

Hypothesis V

Hypothesis V states that poor reader nonresponders will demonstrate significantly lower vocabulary scores than those achieved by good reader responders to formats A, B, or C. This hypothesis suggests that children who do not respond to the compensatory nature of the format attempted, would be found deficient in a language skill other than that which was compensated for in either format, i.e., vocabulary. Conversely, it was expected that poor reader nonresponders would be found undifferentiated from the control group with respect to that language ability for which a given format purported to compensate. For example, a nonresponder to Format B should demonstrate adequate syntactic ability. The hypothesis was tested first with respect to Format B and then with regard to Format C. Table 10 compares the mean language scores of nonresponders to B and C with those of the control group.

Table 10

Mean Performance Scores of Poor Reader Nonresponders Versus Controls on Three Language Measures

		Vocabulary	Syntax (Hunt-O'Donnell)	Syllabication (Listening for Syllables)
Controls n = 22	Mean	14.93 yrs.	11.52 yrs.	27.36/30
	S.D.	2.08	1.76	2.42
Nonresponders to Format B n = 10	Mean	12.82 yrs.	9.95 yrs.	28.50/30
	S.D.	1.54	2.31	1.18
Nonresponders to Format C n = 10	Mean	11.28 yrs.	10.95 yrs.	27.80/30
	S.D.	1.25	2.02	3.36

The Hoteling t^2_2 procedure for two independent groups was performed independently for Formats B and C. The results of this multivariate analysis which compared good reader responders to all formats (controls) with poor reader nonresponders to Format B may be found in Table 11.

Table 11

Differences in Language Abilities Between Two Reading Groups Controls versus Nonresponders to B

	Tests for Each Variable				
Variable	T**2	DF1	DF2	F	P
1. Vocabulary	8.201	3	28	2.552	0.076
2. Syllabication	1.964	3	28	0.611	0.613
3. Syntax	4.516	3	28	1.405	0.262

T**2 = 11.826　　DF1 = 3　　DF2 = 28
F-ratio = 3.679264　　Probability= 0.023715

n_1 = 22 = Good Readers　　n_2 = 10 = Poor Readers

The results of this analysis indicated that poor readers who did not benefit from Format B, i.e. nonresponders were not significantly different from good readers with respect to either syntactic skills or syllabication ability. This observation lends support to Hypothesis III with respect to the selective benefits of individual formats. For example, poor readers who benefited from Format B were selectively impaired in syntactic ability while those who did not benefit demonstrated age appropriate syntactic ability. This suggests that poor readers will not benefit from linguistically manipulated text which selectively compensates for a skill with which they are proficient.

The multivariate analysis performed over three variables with respect to Format C may be found in Table 12.

Table 12

Differences in Language Ability for Two Reading Ability Groups - Responders vs. Nonresponders to C

	Tests for Each Variable				
Variable	T**2	DF1	DF2	F	P
1. Vocabulary	26.060	3	28	8.108	0.000
2. Syllabication	0.175	3	28	0.054	0.987
3. Syntax	0.667	3	28	0.207	0.800

T**2 = 27.914
DFL = 3
DF2 = 28
F-ratio = 8.684359
Probability = 0.000313

n_1 = 22 = Good Readers
n_2 = 10 = Poor Readers

The results depicted in Table 10 indicated that poor reader nonresponders to Format C demonstrated scores in both syntactic and syllabication ability which were not significantly different from those evidenced by the good reader responders to all formats. Conversely, poor reader nonresponders achieved significantly lower scores on the vocabulary measure than did good reader responders ($F= 8.108$, $p < 0.001$). Hypothesis V with respect to the results obtained for Format C is supported. Poor readers who do not profit from the syllabicated format are deficient in vocabulary skills when compared to good reader responders to A, B, and C. This finding suggests that decoding through syllabication is highly dependent upon being able to gestalt syllables into recognizable words.

Language Patterns of Responders and Nonresponders

The language patterns of poor reader responders as opposed to that of poor reader nonresponders with respect to their performance on syntactically reduced Format B is graphically depicted in Figure 2. As is evident, responders appear deficient in syntax ability, when compared to good reader responders to A, B, and C. The apparent difference in syllabication ability was not significant. Nonresponders demonstrate the opposite pattern. Neither syntax ability nor syllabication ability differentiates this group from the good reader responders. The results suggests that since the nonresponders were not selectively impaired in syntax ability, textual materials which compensate for that

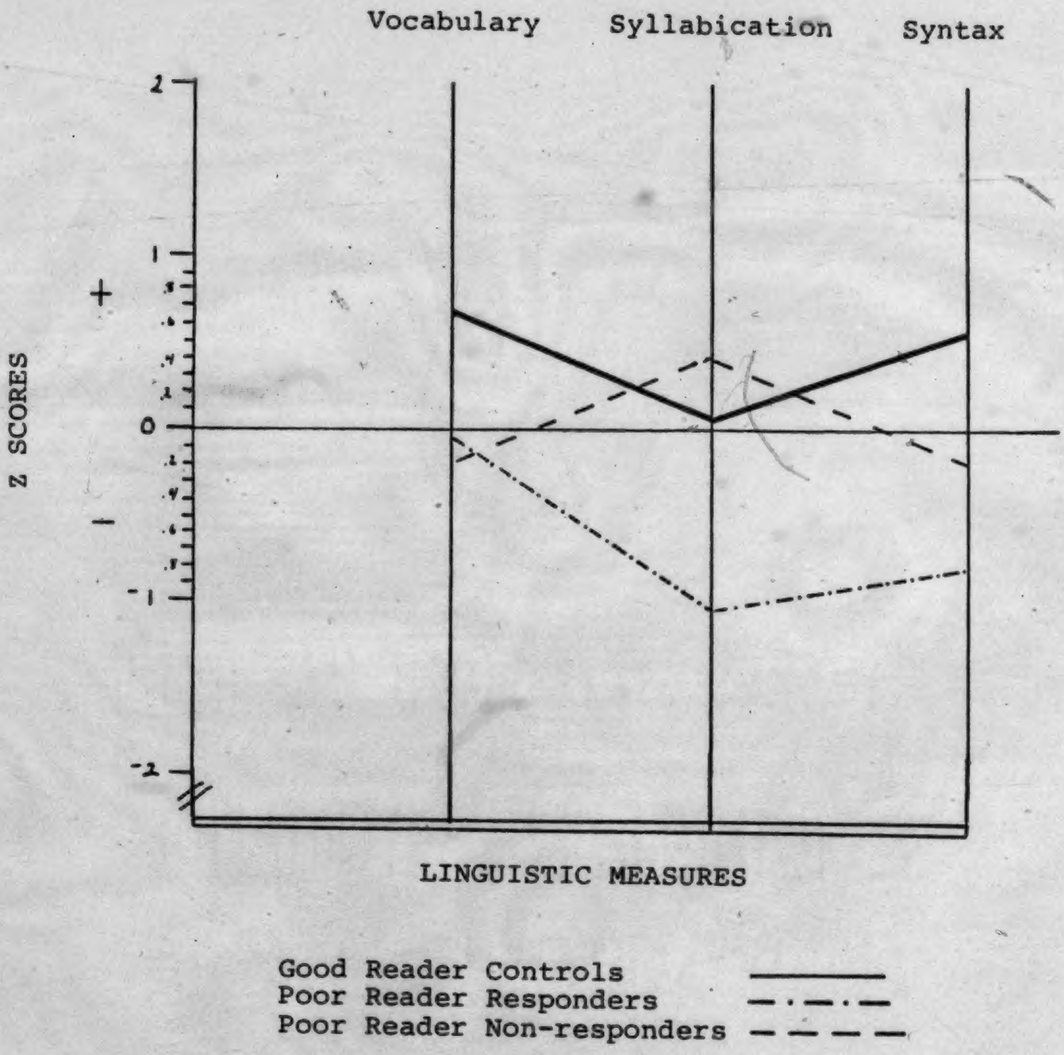

Figure 2: Language Characteristics of Responders versus Nonresponders to Format B (syntax reduced)

language skill would not result in integration of language skills. Therefore no gains in reading comprehension could be expected. The pattern for nonresponders also suggests that these students would not benefit from Format C, i.e. syllabicated material since vocabulary skills appear somewhat weak. There appears to be a lack of integration between the lexical and syntactic aspects of the reading process. One might speculate that the nonresponder group would profit from textual manipulations which reduced the level of vocabulary demanded by the reading selection. Interestingly enough, the lowest linguistic scores overall are evidenced by the responder group. This observation suggests that specific language difficulties rather than overall weak language ability result in the failure to comprehend a reading. The poor reader responders demonstrated that when a reading selection was matched to their capacity to process some aspect of language, their ability to integrate reading skills increased dramatically. This may account for the paradoxical fact that many children with borderline IQ scores read adequately for their mental age while otherwise bright children may demonstrate severe reading difficulties (Bannatyne, 1971).

With respect to Format C, the analysis demonstrated that poor reader responders are identifiable by a pattern characterized by good vocabulary and syntactic skills. Results for Format C are graphically depicted in Figure 3. As is evident, the pattern for nonresponders is somewhat

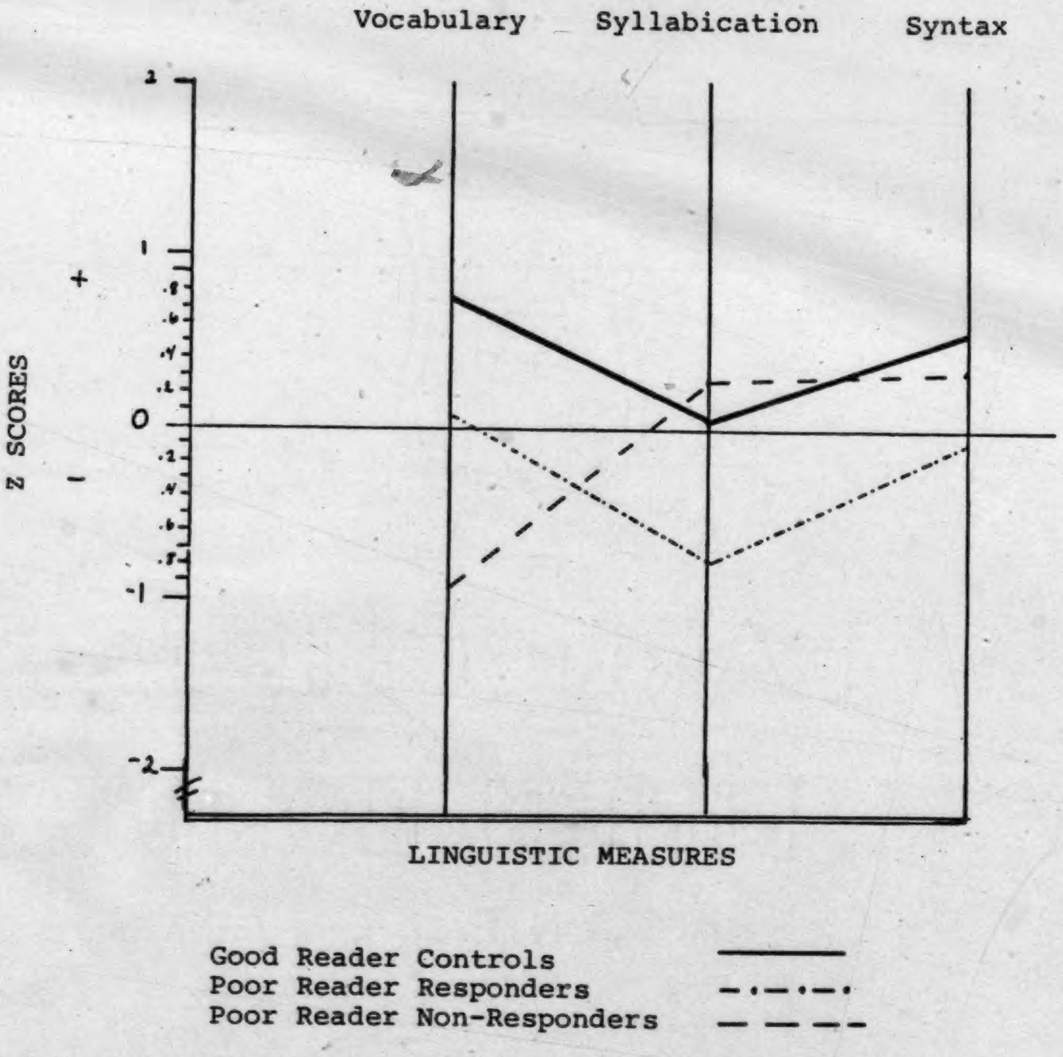

Figure 3: Language Characteristics of Responders versus Nonresponders to Format C (syllabicated)

reversed. The latter children demonstrated age appropriate scores on both the syntactic and syllabic measures, but did demonstrate significantly low vocabulary scores. These results suggest than an interdependency exists with respect to vocabulary and syllabication, in that decoding skills are dependent upon the prior possession of a fund of lexical items with which to gestalt syllables into meaningful words. It seems evident that non-responders to Format C would not profit from remedial procedures which place priority on decoding skills. Again, skill integration might be achieved through vocabulary reduced reading materials.

Summary and Implications

This study has attempted to assess the differences in language ability between good and poor readers at the grade six level. The results indicate that good readers scored significantly higher on measures of expressive syntax and receptive vocabulary than did poor readers. Conversely, the groups were not significantly differentiated by the receptive syllabication measure. Pearson product-moment correlational data yielded significant correlations between reading ability and both syntactic ability and vocabulary awareness. Syllabication ability was found to be unrelated to the language measures as well as unrelated to reading ability at the grade six level. These results suggest that vocabulary and syntax abilities may be prerequisite to or underlie the reading process. With respect to the ability to segment the sound stream, the results here suggest that as a nonmeaningful linguistic ability, syllabic awareness may be developed only to the extent that words cannot be anticipated from context. One might then expect that children, weak in vocabulary skills, would be more reliant on syllabication skills than are children who possess facility with words. Such a conclusion is suggested by the observed weak syllable test scores of many proficient readers with superior vocabulary ability. Syllabication skills do not appear to be important correlates of reading ability, although they may have been at earlier stages of reading acquisition.

Related to the hypothesized dependency of reading upon adequate linguistic ability, is the degree to which component skills are interdependent in fluent reading. The results of providing children with parallel versions of a comprehension test, which were structurally manipulated to compensate for a weak skill area evidenced support for the assumption of interdependent skills. Although good and poor reader groups were found to differ significantly in actual reading ability, as measured by the Schonell, the effect of structurally manipulated formats was to eliminate the differences in comprehension ability scores between the two groups. Support for the validity of these results is demonstrated by significant comprehension score differences on the unaltered version of the same test.

A major postulate of this investigation was that since linguistic structures are directly represented in script, integration of reading skills may be dependent upon the degree to which children are able to integrate language. As previously suggested, language difficulties are not always apparent in the oral expression of children, because they tend to use only those linguistic structures with which they are proficient. However, this implies that integrated processing does take place at some level of linguistic competence.

Reading difficulty may occur in response to a failure to integrate language components at the level of competence required by script. Such integration is suggested to be dependent upon cognitive representations of speech structures. This view suggests that such representations must exist in order that these structures be recognized and processed.

It was hypothesized that poor readers who demonstrated an integrated response to a format, which reduced the linguistic demands on a specific language ability, would also demonstrate weak ability in that skill at the oral level. This hypothesis received partial support in the present study.

Those poor readers who responded to syntactically reduced format, demonstrated significantly lower syntax scores than did good reader responders to all formats. Nonresponders were undifferentiated from controls with respect to syntax ability.

Poor reader responders to the syllabicated format did not demonstrate significantly lower syllabication scores than those of good readers. A language pattern of adequate vocabulary and syntactic ability concommitant with a low or borderline syllabication score was found to be significant.

Again concerning format C, the results for nonresponders i.e., those children who did not profit from this format, demonstrated that these children were significantly deficient in vocabulary ability as compared to good reader controls. This again supports the idea that syllabication skills are useful only to the extent that they enable the reader to make a match between speech segments and the recognition of words as they exist in the oral vocabulary of the child. The children did however demonstrate syllabication and syntax scores which did not significantly differ from those of good reader controls.

It should be noted here that 15 percent of the poor reader group demonstrated adequate, i.e. age appropriate, language skills. This is similar to the 10 to 13 percent of dyslexic children identified by Denckla (1977) and Mattis, French and Rapin (1975) as visuo-perceptually impaired. Future studies might provide additional measures with which to assess these visual skills in relation to language skills. In addition, several children were excluded from participation in the present study because they were classed as slow rather than impaired readers. Strang (1969) suggests that such children are unfairly penalized by timed tests, in that their scores will be depressed relative to faster readers. In unstructured reading situations such children may demonstrate that their slow thoughtful approach results in good reading comprehension. It would be interesting to compare slow and disabled readers in order to ascertain if they represent a qualitatively different picture of language development.

point, there is clearly a need to investigate normal or typical syntactic and syllabic development in school age children, in order to determine appropriate difficulty levels for textual materials at different grade levels.

Finally, the findings concerning the effectiveness of current remedial practice suggest the need for determining the value of reducing the linguistic demands of textual materials as a maintenance procedure for poor readers. The Hunt (1970) study demonstrated that syntactic development appears to continue at least to adulthood. This being the case, it would seem plausible that this linguistic ability is remediable. The same situation appears to exist for vocabulary ability. The Arter and Jenkins (1979) review suggested that either underlying skills were not remediable or that the wrong skills are being remediated. Newcomer et al. (1975) write:

> We cannot help but conclude that psycholinguistic training based on the Kirk Osgood model is not successful because it does not help children to increase their ability to speak or understand language, nor does it aid them in academic skills such as reading, writing or spelling...the wrong skills are being remediated. (p. 147)

Consistent with this, the results suggest that fluent reading is highly dependent upon the competence of language skill components which apparently inhere in reading. Further, suggested is that processing during reading is dependent upon the integration of language and/or reading skills equivalent to the demands of script. Therefore, efforts to improve language skills, concurrent with providing the student with structurally altered regular classroom reading material may represent a fruitful approach to remediation. The success of such an approach would be dependent upon a gradual increase in the complexity of restructured readings parallel to specific language skill improvement. The great advantage of such procedures is that intact language skills, i.e. for example, vocabulary, could continue to develop because the child would be exposed to grade appropriate ideas, words and concepts in the regular class thus preventing the cumulative academic and emotional deficits often associated with reading retardation.

Limitations of the Study

Some limitations of the study are immediately apparent. The first of these concerns the use of tests which in themselves are experimental in nature. They were selected both because they appeared to reflect the respective definitions of the language variables as they are described in the research, and because of the paucity of standardized instruments with which to measure these. This was particularly true of the syllabication measure, which as previously stated may have involved short-term memory as a task requirement. Consequently, this test is suspect to both validity and reliability and no doubt contributed a substantial error to the statistical analysis. In retrospect, it would also have been useful to have included a vocabulary reduced format as well as those formats employed. This had been deemed unnecessary because the vocabulary demands of the reading selection appeared minimal. However, the extremely low vocabulary scores of a few of the poor readers demonstrated that such an inclusion would have been desirable.

Another limitation concerns the rather small number of subjects who participated in the study. Since current reading scores were not available, the sample was originally teacher selected. Subsequent screening reduced the numbers considerably. Consequently, in the present study, the results obtained must be accepted with reservation. The investigation should be replicated using a larger sample. In addition, tests or better tests of the language measures of syllabication and syntax should be developed and evaluated with respect to both validity and reliability prior to the employment of these in further investigations.

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APPENDIX A: EXPERIMENTAL MEASURES USED IN THE STUDY

ALUMINUM

Directions: Read the passage all the way through. You will notice that the sentences are short and choppy. Study the passage, and then rewrite it in a better way. You may combine sentences, change the order of words, and omit words that are repeated too many times. But try not to leave out any information.

Aluminum is a metal. It is abundant. It has many uses. It comes from bauxite. Bauxite is an ore. Bauxite looks like clay. Bauxite contains aluminum. It contains several other substances. Workmen extract these other substances from the bauxite. They grind the bauxite. They put it in tanks. Pressure is in the tanks. The other substances form a mass. They remove the mass. They use filters. A liquid remains. They put it through several other processes. It finally yields a chemical. The chemical is powdery. It is white. The chemical is alumina. It is a mixture. It contains aluminum. It contains oxygen. Workmen separate the aluminum from the oxygen. They use electricty. They finally produce a metal. The metal is light. It has a luster. The luster is bright. The luster is silvery. This metal comes in many forms.

WORDS PER CLAUSE - SCORING KEY

	G4	G6	G8	G10	G12
Low Group	5.04	5.31	6.09	6.87	7.42
Middle Group	5.19	5.92	6.98	7.39	7.72
High Group	5.33	6.05	7.30	7.81	8.39
All Groups	5.19	5.76	6.79	7.35	7.85

BOTEL-GRANOWSKI FORMULA

SUMMARY OF COMPLEXITY COUNTS

O-Count Structures

Sentence Patterns-two or three lexical items

1. Subject-Verb-Adverbial) He ran. He ran home.
2. Subject-Verb-Object (I hit the ball.)
3. Subject-be-Complement-(noun, adjective,adverb) He is good.
4. Subject-Verb-Infinitive (She wanted to play.)

Simple Transformations

1. interrogative (including tag-end questions) Who did it?
2. exclamatory (What a game!)
3. imperative (Go to the store.)

Coordinate Clauses joined by "and" (He came and he went.)

Non-Sentence Expressions (such as Oh, Well, Yes, and then)

1-Count Structures

Sentence Patterns-four lexical items

1. Subject-Verb-Indirect Object-Object (I gave her the ball.)
2. Subject-Verb-Object-Complement (We named her president.)

Noun Modifiers

1. adjectives (big, smart)
2. possessives (man's, Mary's)
3. pre-determiners (some of, non of.....twenty of)
4. participles (in the natural adjective position: crying boy, scalded cat.)
5. prepositional phrases (the boy on the bench....)

Other Modifiers

1. adverbials (including prepositional phrases) when they do not immediately follow the verb in the SVAdv. pattern.)
2. modals (should, would, must, ought to, dare to, etc.)
3. negatives (no, not, never, neither, nor, -n't)
4. set expressions (once upon a time, many years ago, etc.)
5. gerunds (when used as a subject) Running is fun.
6. infinitives (when they do not immediately follow the verb in a SVInf. pattern) I wanted her to play.

Coordinates

1. coordinate clauses (joined by but, for, so, or, yet) I will do it or you will do it.
2. deletion in coordinate clauses (John and Mary, swim or fish: a 1-Count is given for each lexical addition.)
3. paired coordinate "both...and" (Both Bob did it and Bill did it.)

2-Count Structures

Passives (I was hit by the ball. I was hit.)

Paired conjunctions (neither...nor, either...or) Either Bob will got or I will.)

Dependent clauses (adjective, adverb, noun) I went before you did.

Comparatives (as....as, same...as, -er than....more... than) He is bigger than you.

Participles (ed or ing forms not used in the usual adjective position.) Running, John fell. The cat, (scalded) yowled.

Infinitives as Subjects (to sleep is important.)

Appositives (when set off by commas) John, my friend, is here.

Conjunctive Adverbs (however, thus, nevertheless, etc.) Thus, the day ended.

3-Count Structures

Clauses used as Subjects (What he does is his concern.)

Absolutes (The performance over, Mr. Smith lit his pipe.)

Arithmetic Formula for Determining Average Syntactic Complexity

The syntactic complexity of any passage or sampling of sentences is the arithmetical average of the complexity counts of the sentences evaluated. For example if ten sentences had the following counts, their average syntactic complexity would be 2.5.

1.2
2.2
3.3 total 25
4.1
5.2
6.2
7.1
8.4
9.3
10.5 average 2.5

FORMAT A

Throughout the night, the snow fell. Next morning the bustling, noisy city lay crippled under a deep white cover. The snowplows screeched and labored up Sycamore. It was noon before Benny, with Chico's help, had the sidewalk clear outside his father's Barber shop. Here were the seven inches they had hoped for and the schools were closed. And here was the white, freshly fallen snow to play in. Stacking their snow shovels, they made for the vacant lot beside the 'empty'.

"Let's play forts," said Benny. "The first guy to knock out the other's fort will be the winner. You make yours here by the street and I'll make mine up by the 'empty'."

Accepting this arrangement, Chico squatted down in the snow and began scooping and piling it into a high wall facing the 'empty' toward which Benny was trudging.

"Whoever gets his fort finished first can start firing," Chico called, working frantically.

Benny didn't reply, but his steps quickened and the snow spurted away from his hurrying feet. Suddenly he stopped and looked quickly toward the 'empty'. Then he turned and called to Chico.

"Hey, Chico, hold it. Look what I found."

Chico rose slowly, his face dubious. Was this a trick to slow him down? Already a good high heap of snow stood between him and his future target. But it wasn't like Benny to play a trick.

FORMAT B

The city was bustling. It was noisy. Then the snow began to fall. It snowed all night. Morning came. The city was crippled. It lay under a cover of snow. The snow was deep. The snow was white. The snowplows screeched. They labored up Sycamore.

It was noon. Benny had cleared the sidewalk. His friend helped him. His name was Chico. The boys had hoped for snow. They wanted seven inches of snow. Then the schools would have to close. Here was the seven inches. It was white. It was freshly fallen. It was there to play in.

The boys stacked their shovels. They made for the vacant lot. The lot was beside the 'empty'. "Let's play forts," said Benny. "One guy will be the winner. He will knock out the other's fort. But he must do it first. You make your fort here. Make it by the street. I'll make my fort there. I'll make it by the 'empty'. "

Chico accepted the arrangement. He squatted down in the snow. He began scooping up the snow. He began piling the snow. He made the snow into a wall. The wall was high. It faced the 'empty'. Chico yelled, "I'll bet I finish my fort first! Then I'm going to start firing!" He worked frantically!

Benny didn't reply. But his steps quickened. The snow spurted away from his feet. He was hurrying. Suddenly, he stopped. He looked quickly towards the 'empty'. Then he turned. He called to Chico. "Hey Chico, Hold it! Look

FORMAT B

what I found!" Chico rose slowly. His face looked dubious. Was this a trick? Should he slow down? Chico had already piled some snow. It was a good heap. It was a high heap. The snowpile was between Chico and Benny. Benny was the target. Chico wondered, "Was Benny playing a trick? Benny wasn't like that."

FORMAT C

Through-out the night, the snow fell. Next morn-ing the bustl-ing, noi-sy city lay crip-pled un-der a deep white cov-er. The snow-plows screeched and la-bored up Syc-a-more. It was noon be-fore Ben-ny, with Chic-o's help, had the side-walk cleared out-side his fath-er's bar-ber shop. Here were the sev-en in-ches they had hoped for and the schools were closed. And here was the white, fresh-ly fal-len snow to play in. Stack-ing their snow shov-els, they made for the va-cant lot be-side the 'emp-ty'.

"Let's play forts," said Ben-ny. "The first guy to knock out the oth-er's fort will be the win-ner. You make yours here by the street and I'll make mine up by the 'emp-ty'. "

Ac-cep-ting this ar-range-ment, Chic-o squat-ted down in the snow and be-gan scoop-ing and pi-ling it in-to a high wall fa-cing the 'emp-ty' to-ward which Ben-ny was trudg-ing.

"Who-ev-er gets his fort fin-ished first can start fi-ring," Chic-o called, work-ing frant-tic-al-ly.

Ben-ny did-n't reply, but his steps quick-ened and the snow spur-ted aw-ay from his hur-ry-ing feet. Sud-den-ly he stopped and looked quick-ly to-ward the 'emp-ty'. Then he turned and called to Chic-o.

"Hey, Chic-o hold it. Look what I found."

Chic-o rose slow-ly, his face du-bi-ous. Was this a trick to slow him down? Al-read-y a good high heap of snow stood be-tween him and his fu-ture target. But it was-n't like Ben-ny to play a trick.

COMPREHENSION TEST

Circle the number of the best answer:

1. After the snowfall, the city was:
   1. bustling
   2. empty
   3. sunny
   4. snowbound

2. How long did the snow storm last?
   1. All day
   2. Three days
   3. All night

3. How many inches of snow had the boys hoped for?
   1. 3 inches
   2. 7 inches
   3. 12 inches

4. Where were the boys when they were shoveling snow?
   1. Near the 'empty'
   2. At Bennie's house
   3. Outside the barber shop

5. Why were the boys pleased with the snow?
   1. They loved to shovel walks.
   2. They got a holiday from school.
   3. They wanted to go sledding.

6. What did the boys plan that afternoon?
    1. They were going to play a game of war.
    2. They were going to build a snowman.
    3. They were going to play forts.
7. Who could start throwing snowballs first?
    1. The one who finished his fort first
    2. The one who got to the vacant lot first
    3. The one who had the most snowballs
8. Who would be the winner of the game?
    1. The one who could throw the most snowballs
    2. The one who could throw snowballs the farthest
    3. The one who could knock down the other's fort
9. Who was the first to start building his fort?
    1. Sam
    2. Chico
    3. Benny
10. Who found something surprising?
    1. Benny
    2. Chico
    3. Benny's father
11. What do you think he saw?
    1. He found something in the snow.
    2. He saw something in the empty house.
    3. Nothing, he was playing a trick.
12. How can you tell the boys were good friends?
    1. They both like to play forts.
    2. Because Chico trusted Benny not to play a trick
    3. Because, in the story, the boys are together playing

SYLLABICATION LISTENING TEST

Examples: car airplane hamburger

1.	Elephant	3
2.	School	1
3.	Animals	3
4.	Television	4
5.	Microscope	3
6.	Lake	1
7.	Refridgerator	5
8.	Syrup	2
9.	Uniform	3
10.	With	1
11.	Organization	5
12.	Banana	3
13.	Giraffe	2
14.	Flower	2
15.	Cooperate	4
16.	Children	2
17.	Vocabulary	5
18.	Purple	2
19.	Impossible	4
20.	Branch	1
21.	Motorcycle	4
22.	International	5
23.	More	1
24.	Telephone	3
25.	Nationality	5
26.	Aligator	4
27.	Coat	1
28.	Communication	5
29.	Dinner	2
30.	Vaccination	4

SYLLABICATION ANSWER SHEET

DIRECTIONS: Circle the number of syllables you can hear

A, B and C are practice questions.

1.A (1) (2) (3) (4) (5)

2.B (1) (2) (3) (4) (5)

3.C (1) (2) (3) (4) (5)

APPENDIX B: THREE-WAY ANALYSES OF VARIANCE

TABLE I

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Verbal I.Q.

(CCAT)

Source	df.	M.S.	F
Format	2	94.28	0.81
Response	1	180.36	1.55
Format X Response	2	243.75	2.10
Reading Group	1	3758.12	32.40***
Response by Group	1	170.26	1.47
Format X Group	2	63.32	0.55
Format X Response X Group	2	88.41	0.76
Error	72	115.97	

P .05*

P .01**

P .001***

TABLE II

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Performance I.Q.

(CCAT)

Source	df.	M.S.	F
Format	2	265.59	1.89
Response	1	12.27	0.01
Format X Response	2	360.22	2.57
Reading Group	1	2511.30	17.93***
Response by Group	1	32.29	0.23
Format X Group	2	368.81	2.63
Format X Response X Group	2	17.65	0.13
Error	72	140.04	

P .05*

P .01**

P .001***

TABLE III

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Reading Ability

Schonell

Source	df.	M.S.	F
Format	2	0.17	0.43
Response	1	0.00	0.00
Format X Response	2	0.52	1.30
Reading Group	1	64.48	162.22***
Response by Group	1	0.08	0.21
Format X Group	2	0.07	0.18
Format X Response X Group	2	0.30	0.76
Error	72	0.39	

P .05*

P .01**

P .001***

TABLE IV

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Chronological Age.

Source	df.	M.S.	F
Format	2	0.45	1.47
Response	1	0.03	0.10
Format X Response	2	0.37	1.22
Reading Group	1	0.81	2.63
Response by Group	1	0.00	0.00
Format X Group	2	0.45	1.46
Format X Response X Group	2	0.13	0.40
Error	72	0.31	

P. .05*

P. .01**

P. .001***

TABLE V

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Vocabulary.

P P V T

Source	df.	M.S.	F
Format	2	1.37	0.35
Response	1	36.25	9.15**
Format X Response	2	0.02	0.00
Reading Group	1	39.92	7.58**
Response by Group	1	0.01	0.00
Format X Group	2	0.39	0.09
Format X Response X Group	2	5.89	1.48
Error	72	3.96	

P .05*

P .01**

P .001***

TABLE VI

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Syntax Score

Source	df.	M.S.	F
Format	2	5.17	1.76
Response	1	0.29	0.10
Format X Response	2	2.54	0.86
Reading Group	1	33.30	11.31*
Response by Group	1	7.28	2.48
Format X Group	2	2.35	0.80
Format X Response X Group	2	3.73	1.27
Error	72	2.94	

P. .05*

P. .01**

P. .001***

TABLE VII

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Syllabication Score.

Source	df.	M.S.	F
Format	2	1.80	0.21
Response	1	32.78	3.83*
Format X Response	2	13.08	1.53
Reading Group	1	5.01	0.58
Response by Group	1	24.51	0.28
Format X Group	2	36.46	4.27*
Format X Response X Group	2	6.14	0.72
Error	72	8.54	

P. .05*

P. .01**

P. .001***

TABLE VIII

Summary of Analysis of Variance Format Type X Response X Reading Group on the Dimension of Format Reading Comprehension Scores

Source	df.	M.S.	F.
Format	2	19.66	0.27
Response	1	6974.81	94.51***
Format X Response	2	304.19	4.12*
Reading Group	1	284.72	3.86*
Response by Group	1	21.04	0.29
Format X Group	2	192.14	2.60
Format X Response X Group	2	19.43	0.26
Error	72	73.80	

P. .05*

P. .01**

P. .001***

APPENDIX C: MATRIX OF SIGNIFICANT CORRELATIONS

TABLE IX

Matrix of Significant Pearson Product-Moment Correlations on the Dimensions of Language, Reading ability and C C A T I.Q. N = 84

	Vocab.	Syll.	Syntax	Schonell	CCAT-V	CCAT-P	Format Reading
Vocab	1.0	N.S.	0.24*	.44***	0.48***	N.S.	0.45***
Syll	N.S.	1.0	N.S.	N.S.	N.S.	N.S.	-0.33**
Syntax	0.24*	N.S.	1.0	0.33**	0.56***	0.42***	N.S.
Schon.	0.44**	N.S.	0.32**	1.0	0.64***	0.33**	0.31**
CCAT-V	0.48***	N.S.	0.56***	0.64***	1.0	0.47***	0.40***
CCAT-P	N.S.	N.S.	0.42***	0.33**	0.47***	1.0	0.27**
Format	0.45***	-0.33**	N.S.	0.31**	0.40***	0.27**	1.0

P. 0.05*

P. 0.01 **

P. 0.001***

APPENDIX D: SYNTACTIC AND LEXICAL COMPLEXITY AT THE GRADE SIX READING LEVEL

VARIATIONS IN LINGUISTIC COMPLEXITY AT THE GRADE SIX LEVEL

It was morning, and James Douglas awoke frightened. Perhaps it was because the light had not been turned on, and the morning city light itself, was grey and cold, hardly different from early evening. Maybe it was because of the three old women, one bending over the sink, one standing against the wall opposite his bed, one sitting at the table, her head bent over an empty dish. Maybe it was because he had been thinking about how to run away from school, when he went to bed the night before. Maybe it was because it was a cold November Monday. He closed his eyes and pretended to sleep.

(Excerpt from Reading 360, Book 12
Skills Handbook, 1971)
Botel-Granowsky complexity level 3.3

Once upon a time when the city of Fez was still new, it was ruled by a king named Moulay. The king loved his city. He was proud of it. But many a time he lay awake at night, worrying about it.

"Fez is indeed a fine city," he often said to his wife. "It has everything to make it beautiful and famous. It has mosques with extra-tall towers. It has wonderful palaces like mine. It lies in the middle of a dry and barren land, but magic springs of water flow out of the ground in Fez. These springs give us plenty of water to drink and gardens of sweet smelling flowers. All the same, I worry about Fez."...

(Excerpt from the Ginn Basic Readers,
Book 6, 1966, p. 98)
Botel-Granowsky Complexity level 2.4

Gabee Lajoi tied his cypres boat to the small wharf and sprang lightly ashore. He was shivering, for it was late in the afternoon, and there was a strong autumn wind from the north. It broke the surface of the muddy Mississippi River into spray and drenched Gabee, even though he wore his oilskin slicker.

He turned to watch the swells made by a banana freighter, steaming down river, heading for the Gulf. Every small boat tied nearby was bobbing up and down with the crashing swells. The Lajoi family fishing boat, "Seraphine L.," creaked as it rocked at anchor...

(Excerpt from Ginn Basic Readers,
Book 6, 1961, p. 10)
Botel-Granowsky complexity level 2.1

As can be noted in the foregoing excerpts, script arbitrarily determines the level of linguistic proficiency required for reading comprehension. The first excerpt (Reading 360) stresses syntactic rather than vocabulary knowledge. Therefore, a reader weak in syntactic ability might be expected to understand little of this reading, regardless of his vocabulary ability.

The second excerpt is representative of a more balanced approach with respect to syntactic and vocabulary ability. This style of writing offers the reader a choice in reading strategy. Conversely, the last excerpt places linguistic demand on the vocabulary skills of the reader with only moderate emphasis on syntax.

APPENDIX E: SCHONELL READING TEST

THE SCHONELL READING TESTS

ITEM - CONTENT

SILENT READING TEST A

Instructions for administering the test, with average number of questions correct and times taken, are given in Backwardness in the Basic Subjects, by F.J. Schonell, pp. 510-512 and in Reading and Spelling Tests Handbook of Instructions.

Read carefully each paragraph and the question at the end of it. Write the answers to the questions on your answer paper. (Time-9 minutes).

(a) I have a cat. It is black and white. It is one year old. It sleeps in a box. It likes to play with a ball of wool.

Where does the cat sleep?

(b) Every now and then along the roads we see low wooden houses with tightly shut windows and little gardens stocked with flowers.

Choose the word below that tells about the windows, and write it on your answer paper:

Half-open open closed apart

1. I am a wild bird, My home is in a tree. I can fly fly high in the air. I can sing a song.

   Where is the bird's home?

2. We have a baby. When we speak to him he waves his little hand. He has ten teeth.

   How many teeth has the baby?

3. Last Monday we went to the Zoo. We spent much time in front of an iron cage which held seven monkeys. They made us laugh when they put out their paws for nuts.

   What was the monkeys' cage made of?

4. It was getting so dark that Alice thought there must be a storm coming on. "What a thick black cloud that is!" she cried. "And how fast it comes! Why, I do believe it's got wings."

   Do you think the sun was shining? Yes. No. Cannot tell.

5. Hans took the stone and went off with a light heart; his eyes sparkled for joy and he said to himself, "I must have been born in a lucky hour; everything that I wish for comes to me of itself."

   Was Hans happy or unhappy?

6. In some cities coloured lights are used to direct the cars at cross streets. A red light means "Stop," an orange light means "Get Ready," and a green light means "Go."

   What light is used for "Get Ready"?

7. There was once a shoemaker who worked very hard and was very honest, but still he could not earn enough to live on, and at last all he had in the world was gone except enough leather for one pair of shoes.

   Choose the word below that tells what the shoemaker was and write it on your answer paper:

   lazy dishonest hardworking proud idle

8. When a duck wants tocome to rest on water it draws its head backward, tilts its body upward, thrusts its feet forward and spreads its tail outward.

Choose the word below telling how the duck places its head. Write it on your answer paper:

upward forward backward downward

9. I can skip, I go to school every day, I wear a pretty dress, I have long hair.

What am I?

10. Long ago there lived on the sea coast of Japan a young man names Yaina, a kindly fellow and clever with his rod and line.

Write the word Yaina on your answer paper. If you think he was a fisherman, put a line under his name: if you think he was not, put a cross under his name.

11: The daylight is dying
Away in the West,
The wild birds are flying
In silence to rest.

Do these lines tell about evening or morning?

12. Over the meadow
In the reeds on the shore
Lived a mother water-rat
And her little water-rats four

How many water-rats altogether lived in the reeds?

13. December is a winter month in England, but in Australia it is summer at that time of the year. Christmas day comes on 25th December.

Choose the word below which tells what Christmas Day in Australia is likely to be. Write it on your paper:

windy freezing hot cold frosty

14. A sailor dropped the captain's silver tea-pot into the sea. The captain went to the sailor and said to him, "You let my tea-pot fall into the sea, did you not? It is lost." "No, no," said the sailor, "I know where it is. It is at the -----of the sea."

Write the word that has been left out.

15. If you are waiting on shore for a ship to come in, the first thing you see is the smoke, later the funnels and masts come in sight, and lastly the hull of the ship itself is seen.

Suppose you were watching a ship leaving the land. Choose the word below that tells you the last thing you would see. Write it on your paper:

people masts smoke funnels hull

16. Behind the little house were apple trees, a plum tree and two or three pear trees. Then came a stretch of rough grass and a stone wall with a gate leading into the pasture.

Was the stone wall in front, behind, or at the side of the house?

17. A field mouse had a friend who lived in a house in town. Now the town mouse was asked by the field mouse to dine with him, so out he went and sat down to a meal of wheat.

Where did they dine? At the field mouse's home, or at the town mouse's home?

18. Upon a mountain height, far from the sea,
I found a shell,
And to my listening ear the lonely thing
Ever a song of ocean seemed to sing,
Ever a tale of ocean seemed to tell.

Which seemed to sing a song? The mountain, the shell, or the ocean?

ANSWERS

(a) In a box
(b) Closed
1. In a tree
2. Ten
3. Iron
4. No
5. Happy
6. Orange or yellow or amber
7. Hardworking
8. Backward
9. Girl
10. Yaina
11. Evening
12. Five
13. Hot
14. Bottom or bed
15. Smoke
16. Behind
17. Field Mouse's home
18. Shell

NORMS

Table 4

Average number of Questions Correct in 9 Minutes

BOYS

Score	Reading Age		Score	Reading Age	
	Yrs	Mths		Yrs	Mths
1	6	9	9	8	11
2	6	11	10	9	4
3	7	2	11	9	9
4	7	6	12	10	13
5	7	9	13	10	10
6	7	11	14	11	4
7	8	12	15	11	10
8	8	7	16	12	4

Table 5

Average Number of Questions Correct in 9 Minutes

GIRLS

Score	Reading Age		Score	Reading Age	
	Yrs	Mths		Yrs	Mths
1	6	9	10	9	10
2	6	10	11	9	5
3	7	0	12	9	11
4	7	3	13	10	5
5	7	6	14	10	10
6	7	9	15	11	4
7	7	11	16	12	0
8	8	2	17	12	0
9	8	7	--	--	--